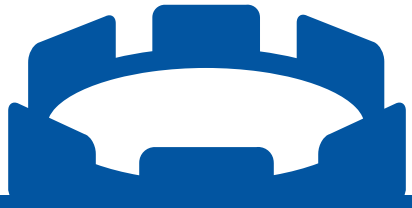

THE FUTURE OF THE BIO-BASED ECONOMY IN CANADA

Roundtable Outcomes Report

Public Policy Forum
Forum des politiques publiques

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BIOTECanada

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EXECUTIVE SUMMARY

On May 11th, 2009, the Public Policy Forum (PPF) convened over 100 experts from industry, academia, and governments for a multi-stakeholder roundtable on the future of the bio-based economy in Canada. The purpose of the full-day event was to engage in honest, unfiltered dialogue about the strategic opportunities and challenges facing the bio-based economy—and to share information and generate ideas for possible next steps. The following key messages emerged from the presentations and table discussions.

1. ***The long-term opportunities for the bio-based economy are significant.***

The 21st century's signature challenges present long-term opportunities for bio-based solutions. Global population growth is putting pressure on food and water supplies; climate change is driving a push for more sustainable forms of energy production; and health care costs are rising along with aging populations in developed countries. Biotechnology offers possible solutions to these challenges. Examples range from bio-fuels, to disease-resistant plants, to cold water detergent. In the Canadian context, biotechnology also offers the promise to revitalize traditional industries that have been affected by the global recession, through the integration of bio-materials into manufacturing value chains. The question is whether Canada will be at the forefront of the development of such solutions. According to the OECD, by 2015 virtually all new drugs, about half of major crops around the world, and an increasing number of everyday products will be produced using biotechnology.

2. ***A series of obstacles stand in the way of realizing the potential of the bio-based economy in Canada.***

The bio-based economy faces a range of challenges, which vary from sector to sector. The health, medical and pharmaceutical sector is experiencing declining drug discovery productivity, despite increased investment. This has prompted some to question the sustainability of the current business model of drug development.

The anxiety about sustainability is shared across other sectors of the bio-based economy. CEOs reported in December 2008 that up to 50 percent of emerging biotechnology firms lack the cash needed to stay open past the end of 2009. One of the main challenges from this perspective is the venture capital environment in Canada. Access to venture capital for Canadian entrepreneurs is declining, and when entrepreneurs do find investors they are given less "runway"—*i.e.* investors pull out if the company is not immediately successful. Moreover, if a company is successful, Canadian investors tend to sell once their investment has paid off, a dynamic that inhibits the development of home-grown global companies.

The economic downturn is also wreaking havoc on the industry receptors for biotechnology. If the bio-economy is to revitalize traditional industries, then there has to be something left to revitalize.

3. ***The most significant challenge is the "culture of complacency" in Canada with respect to entrepreneurship and innovation.***

Perhaps the most significant challenge, however, is more deeply rooted. There was broad agreement that Canada suffers from a culture of complacency when it comes to entrepreneurship and innovation. This culture was described at various points as being "content", "risk averse", or "understated". Participants speculated about the reasons for this culture of complacency. One is that Canada is a relatively wealthy country with a strong social safety net. Another is that Canada is comfortably integrated into the huge North American economic space. For some, this discussion dovetailed with a recent report on the role of business strategy in Canada's poor innovation and commercialization performance. According to this view, the lack of business demand for innovation is the primary cause of the commercialization problem in Canada—not the supply of research from university labs, which for over a decade have been the focus of public funding to encourage innovation and the creation of high value jobs.

A number of speakers suggested that Canadians should not take our current prosperity for granted. Though acknowledging that culture is hard to change, many participants argued for increased emphasis in the educational system on entrepreneurship. Others said Canada should do a better job at "celebrating", "rewarding", or "recognizing" entrepreneurship. To the extent that these would encourage young entrepreneurs, participants felt that both suggestions would help develop the management expertise that is critical to attracting investment in cutting-edge biotech companies.

4. ***Participants suggested a number of next steps to move the bio-based economy forward in Canada.***

One of the clear messages that came out of the table discussions is the need for **more effective collaboration and information-sharing across all parts of the bio-economy** in order to identify common challenges and a unified approach toward solving them. Many participants spoke of the need to break out of the internal silos within the bio-economy—across the health sector, bio-fuels, agriculture, and bio-materials. The need for more collaboration raised a more profound issue, which was to define the bio-based economy and to galvanize all stakeholders around that vision. "We need to figure out who we are, where we want to go, and then work together rather than compete," according to one participant. If there is debate internally about how the bio-economy fits together, we heard, how can stakeholders expect to convey their message externally? There is a possible tension, however, between the need to align stakeholders around a common vision, and a sense of urgency expressed by some participants: enough talk, they said; we need to act.

A second, related, theme that ran through the day was the need to for **more effective collaboration across all sectors of society**. For some this meant better communication between regulators and biotech companies. The *regulatory environment* in other countries, we heard, is more nimble—which puts Canadian companies at a competitive disadvantage. Others focused on the need for stakeholders to continue to experiment with creative

approaches to *intellectual property.* Participants debated the merits of "open access science", in which all research results are put into the public domain. Open access creates a space within which researchers and organizations can collaborate to increase the aggregate level of knowledge in pioneer areas of science. Private firms can then launch their own proprietary drug discovery efforts with less chance of failure. The private sector has begun investing in some open access projects. Federal granting councils now offer a range of IP options for academic and industry research partners.

Finally, a number of recommendations from participants fell under the broad category of **industrial strategy**.

- Some felt that increased *competition*—internally and internationally—would force Canadian firms to become more innovative and to take a global export orientation. From this perspective, the two key strategies are to lower internal trade barriers among provinces and to support next generation trade agreements such as the upcoming negotiations between Canada and the European Union on a new economic partnership.

- Another suggestion—not necessarily consistent with increased competition—was for *strategic procurement* by governments of Canadian bio-products.

- The venture capital crisis, combined with the ongoing commercialization challenge of turning research into marketable products, prompted some participants to suggest that we need to re-evaluate our approach to incentivizing *commercialization*. These participants felt that governments should not just focus on technology transfer offices, but also on actual entrepreneurs. One participant suggested that Canada should establish a national venture capital fund to help seed start-up companies. Provinces are getting into the act: Ontario announced such a fund in 2008; Quebec and several other partners introduced a new capital fund in April 2009.

SOMMAIRE

Le 11 mai 2009, le Forum des politiques publiques (FPP) a convoqué plus de 100 experts de l'industrie, du monde universitaire et des gouvernements à une table ronde regroupant des intervenants multiples sur l'avenir d'une économie basée sur la biotechnologie au Canada. Cet événement d'une journée avait pour objectif de lancer une discussion franche et non biaisée sur les occasions et les défis stratégiques auxquels fait face l'économie basée sur la biotechnologie, de partager ces informations et de générer des idées pour de possibles étapes à venir. Voici les messages clés qui ont émergé des présentations et des tables rondes.

1. ***Les opportunités à long terme pour une économie basée sur la biotechnologie sont de taille.***

Le leitmotif des défis posés par le XXIe siècle présente des occasions de solutions d'origine biotechnologique. La croissance de la population mondiale crée des pressions sur les approvisionnements en eau et en nourriture, les changements climatiques incitent à la production d'énergie renouvelable, et les coûts des soins de santé augmentent de concert avec le vieillissement des populations dans les pays développés. La biotechnologie offre des solutions possibles à ces défis. À titre d'exemple, citons les biocarburants, les plantes résistantes aux maladies et les détergents utilisant de l'eau froide. Dans le contexte canadien, la biotechnologie promet également de revitaliser les industries traditionnelles, qui ont subi les effets négatifs de la récession mondiale, en intégrant des matières d'origine biotechnologique dans les chaînes de valeur de la fabrication. Il s'agit de savoir si le Canada jouera un rôle de premier plan dans le développement de telles solutions. Selon l'OCDE, d'ici 2015 presque tous les nouveaux médicaments, environ la moitié des principales récoltes à travers le monde et un nombre croissant de produits d'usage quotidien seront fabriqués en utilisant la biotechnologie.

2. ***Plusieurs obstacles jalonnent la voie d'une économie basée sur la biotechnologie au Canada.***

Une telle économie doit faire face à des défis qui varient selon les secteurs d'activités. Les secteurs de la santé, médical et pharmaceutique affichent une baisse de productivité au niveau de la découverte des médicaments, malgré des investissements accrus. Cet état de choses a suscité des doutes sur la viabilité du modèle commercial actuel de développement des médicaments.

Le malaise lié à la viabilité est partagé parmi tous les secteurs de l'économie basée la biotechnologie. Les PDG ont rapporté en décembre 2008 que jusqu'à 50 pour cent des entreprises de biotechnologie émergentes manquent des liquidités requises pour rester en affaires au-delà de 2009. Dans cette perspective, l'un des plus grands défis est l'environnement du capital de risque au Canada. Pour les entrepreneurs canadiens, l'accès au capital de risque est en déclin; et lorsqu'ils trouvent des investisseurs, ces derniers leur donnent moins de marge de manœuvre - autrement dit, les investisseurs se retirent si l'entreprise ne réussit pas immédiatement. En outre, lorsque l'entreprise réussit, les

investisseurs canadiens ont tendance à vendre dès qu'ils ont tiré des bénéfices de leurs investissements; cette dynamique limite le développement d'entreprises mondiales nées au Canada.

La baisse des activités économiques fait également des ravages parmi les industries qui pourraient tirer profit de la biotechnologie. Si une économie basée sur la biotechnologie doit revitaliser les industries traditionnelles, encore faut-il qu'il reste quelque chose à revitaliser.

3. ***Le défi le plus significatif du Canada est sa « culture de la complaisance » envers l'esprit d'entreprise et l'innovation.***

Le défi le plus significatif a peut-être des racines plus profondes. La plupart des participants s'entendent pour dire que le Canada souffre d'une culture de la complaisance envers l'esprit d'entreprise et l'innovation. Cette culture a été décrite à diverses reprises comme étant « satisfaite », « anti-risque » ou « sous-évaluée ». Les participants ont spéculé sur les causes de ce phénomène. On a suggéré que le Canada est un pays relativement riche qui jouit d'un filet de sécurité sociale assez robuste. On a également suggéré que le Canada est confortablement intégré dans l'énorme espace nord-américain. Pour certains, ces discussions concordent avec un rapport récent sur le rôle que la stratégie d'entreprise a joué dans la piètre performance du Canada en termes d'innovation et de commercialisation. Selon ce point de vue, le fait que les entreprises exigent peu d'innovations est la cause principale du problème de commercialisation au Canada – et non la recherche provenant des laboratoires universitaires qui, depuis plus de dix ans, ont fait l'objet d'un financement public visant à encourager l'innovation et la création de postes de haut niveau.

Plusieurs conférenciers ont suggéré que les Canadiens ne doivent pas tenir pour acquise leur prospérité actuelle. Tout en reconnaissant que la culture est difficile à changer, plusieurs participants ont souligné l'importance de mettre davantage l'accent sur la promotion de l'esprit d'entreprise dans le système d'éducation. D'autres ont indiqué que le Canada doit mieux « célébrer », « récompenser » ou « reconnaître » l'esprit d'entreprise. Dans la mesure où ces stratégies sont susceptibles d'encourager les jeunes entrepreneurs, les participants ont considéré que ces deux suggestions pourraient favoriser le développement d'une expertise en gestion qui joue un rôle crucial pour attirer des investissements dans des entreprises d'avant-garde en biotechnologie.

4. ***Les participants ont proposé une série d'étapes à parcourir pour faire avancer l'économie basée sur la biotechnologie au Canada.***

Un des messages très clairs qui s'est dégagé de ces tables rondes est le besoin d'une **collaboration et d'un partage d'informations plus efficaces entre tous les secteurs d'une économie basée sur la biotechnologie** afin d'identifier les défis communs et de développer une approche unifiée pour les surmonter. Plusieurs participants ont insisté sur le besoin de briser les barrières à l'intérieur même de l'économie basée sur la biotechnologie - entre les secteurs de la santé, des biocarburants, de l'agriculture et des matières biotechnologiques. Le besoin d'une collaboration accrue a soulevé une question plus profonde, celle de définir

l'économie basée sur la biotechnologie et de mobiliser tous les intervenants autour de cette vision. Selon un participant : « Nous devons définir ce que nous sommes, la direction que nous voulons prendre, et travailler ensemble au lieu de nous faire concurrence. » Une autre voix a également mentionné : si la cohérence même d'une économie basée sur la biotechnologie fait l'objet d'un débat interne, comment les intervenants peuvent-ils espérer véhiculer leur message sur la place publique? Il existe cependant un potentiel de tension entre le besoin de regrouper les intervenants autour d'une vision commune et un sentiment d'urgence exprimé par certains participants : assez parlé, disent-ils, il faut agir.

Un autre thème relié à cette question a circulé toute la journée : le **besoin d'une collaboration plus efficace entre tous les secteurs de la société**. Pour certains, cela signifie une meilleure communication entre les organismes de réglementation et les entreprises de biotechnologie. L'*environnement de réglementation* dans d'autres pays, a-t-on dit, est plus souple - ce qui crée un désavantage concurrentiel pour les entreprises canadiennes. D'autres ont insisté sur le besoin pour les intervenants de continuer d'explorer des approches créatrices au niveau de la *propriété intellectuelle*. Les participants ont débattu du bien-fondé d'un « libre accès à la science », selon lequel tous les résultats de la recherche passent au domaine public. Le libre accès crée un espace permettant aux chercheurs et aux organisations de collaborer en vue d'accroître le niveau général des connaissances dans des domaines d'activité scientifique pionniers. Les entreprises privées peuvent alors lancer leurs propres efforts de découverte de médicaments brevetés et réduire ainsi leurs risques d'échec. Le secteur privé a commencé à investir dans certains projets d'accès libre. Les organismes fédéraux subventionnaires offrent maintenant plusieurs options de propriété intellectuelle (PE) pour les partenaires de recherche des universités et de l'industrie.

Enfin, plusieurs recommandations des participants ont été regroupées dans la catégorie générale de **stratégie industrielle**.

- Certains ont proposé qu'une concurrence accrue, au Canada et à l'échelle internationale, forcerait les entreprises canadiennes à innover et à s'orienter vers une exportation à l'échelle mondiale. Dans cette perspective, les deux stratégies clés consistent à réduire les barrières commerciales internes entre les provinces et à soutenir la prochaine génération d'accords commerciaux tels que les négociations imminentes entre le Canada et l'Union européenne sur un nouveau partenariat économique.

- Une autre suggestion - qui ne cadre pas nécessairement avec l'idée de concurrence accrue - est celle d'approvisionnements stratégiques, par les gouvernements, en produits biotechnologiques canadiens.

- La crise liée au capital de risque, combinée au défi continu posé par la commercialisation qui doit transformer les résultats de la recherche en produits commercialisables, a incité certains participants à suggérer qu'il fallait réévaluer notre approche sur les mesures incitatives liées à la *commercialisation*. Selon ces participants, les gouvernements ne doivent pas seulement se concentrer sur des bureaux de transfert de technologie, mais également sur les entrepreneurs. Un participant a suggéré que le Canada doit établir un

fonds national de capital de risque destiné à fournir des capitaux de démarrage aux entreprises. Des provinces ont déjà commencé à prendre de telles mesures : l'Ontario a annoncé la création d'un tel fonds en 2008, le Québec et quelques autres partenaires ont introduit un nouveau fonds de capital en avril 2009.

INTRODUCTION

The "bio-based economy" is defined by the application of biological tools and processes to the production of food, energy, chemicals, materials, and medical treatments. Examples of the products generated by the advancement of scientific knowledge in biotechnology include bio-fuels; vaccines and diagnostics; pest- and disease-resistant grains; and a range of bio-materials including car parts, furniture, building materials, and petroleum-free plastics. According to the OECD's April 2009 report on *The Bioeconomy to 2030*:

> The application of biotechnology to primary production, health and industry could result in an emerging "bioeconomy" where biotechnology contributes to a significant share of economic output. The bioeconomy in 2030 is likely to involve three elements: advanced knowledge of genes and complex cell processes, renewable biomass, and the integration of biotechnology applications across sectors.[1]

The scope of the bio-based economy in Canada is already significant. BIOTECanada estimates that the economic footprint of the bio-based economy was almost $75-billion in 2007, comparable to the information and communications technology sector and the automotive sector.[2] This figure includes firms that develop biotechnology, those that use biotechnology, and those that provide support. Some foresee a future where plants could be the foundation of the economy, with the potential to re-invigorate traditional industries such as plastics and automobile manufacturing.[3]

Given this promise, many countries, such as the United States and Singapore, are investing aggressively in biotechnology; some, such as India, are pioneering innovative partnerships between industry and academia; while others, such as Ireland, are building the fiscal and regulatory environments in which biotechnology can flourish.

In Canada, the federal government spent $921-million in 2007-2008 on science and technology activities in biotechnology, mostly in research and development.[4] Many provinces also have active biotech agendas. However, the biotech sector in Canada faces a number of challenges, including attracting investment, commercializing new technologies, and attracting and retaining qualified workers.

On May 11th, 2009, the Public Policy Forum (PPF) convened over 100 experts from industry, academia, and governments for a multi-stakeholder roundtable on the bio-based economy in Canada. The purpose of the full-day event was to engage in honest, unfiltered dialogue that would lead to raised awareness of the strategic opportunities and challenges facing the bio-

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[1] *The Bioeconomy to 2030: designing a policy agenda*, OECD, April 2009. http://www.oecd.org/document/38/0,3343,en_2649_36831301_42570790_1_1_1_1,00.html.
[2] *Beyond Moose and Mountains: Building the World's Leading Bio-based Economy*, BIOTECanada, May 2009.
[3] See. *e.g.* http://www.plant.uoguelph.ca/research/homepages/amohanty/.
[4] Statistics Canada, "Biotechnology scientific activities in federal government departments and agencies 2007/2008," *The Daily*, March 4, 2009.

based economy, and clarity on possible next steps. This report captures the key messages that emerged from the roundtable.

APPROACH

The PPF approach to facilitating multi-stakeholder dialogue is based on the following principles:

- The discussion is conducted in a neutral manner.
- The discussion is based on shared information, including identifying key stakeholders, highlighting relevant research, and drawing attention to areas of disagreement.
- The right players are around the table.
- The results of the dialogue are communicated to key decision-makers and stakeholders to help mobilize action.

Using this template, the roundtable was organized as a neutral space in which participants from all sectors could discuss the opportunities and challenges facing the bio-based economy. In addition to federal and provincial government officials, participants represented the broad range of interests covered by the bio-economy, including bio-fuels, health and medical treatments, agriculture, and industrial products, as well as the investment community and academia.

The format featured presentations in the morning from expert speakers that set the context for and sparked dialogue among participants during afternoon table discussions. Participants received BIOTECanada's strategy document *Beyond Moose and Mountains: Building the World's Leading Bio-Based Economy*, in advance of the session.

Presentations are summarized here and are available on the PPF website (www.ppforum.ca). Discussion, however, was held according to the Chatham House Rule. Comments have not been attributed.

OPENING PRESENTATION: *HOW CANADA MIGHT DEVELOP ITS DRUG DISCOVERY SECTOR*

The health, medical and pharmaceutical sectors make up the largest component of the bio-based economy. In his opening presentation, **Dr. Aled Edwards**, (**Banbury Chair of Medical Research, Banting and Best Department of Medical Research, University of Toronto**) argued, however, that the economics of drug discovery are borderline unsustainable.

Drug discovery is a complex process that takes 12 to 15 years from discovery to product, and it is getting less productive. Despite increased spending on R&D in recent years, the amount of innovative medicines has remained relatively constant. Developing new medicines (as opposed to re-formulations of existing ones) is particularly risky and expensive. Even with

increased investment, 90 percent of pioneer drugs fail. Dr. Edwards estimates that there is one new drug for each $5-billion spent in health research, or one new drug per 15,000 people years of work.

The root of the problem is lack of scientific understanding of human biology: the majority of drugs fail for reasons of efficacy, toxicology, or clinical safety. Policy obstacles such as the need for material transfer agreements slow considerably the process of collaboration among researchers in academia and industry. Another question is the role of university technology transfer offices, which are meant to convert discovery into value. Dr. Edwards questioned whether the legal frameworks put in place by universities were generating a sufficient return on investment.

What can be done? Dr. Edwards suggested continued funding of both basic and focused research. Focused research has to strike a balance between achieving the specific goal, and providing researchers creative opportunities to expand scientific knowledge and to publish their findings—*i.e.* short term "wins" on the way to a long-term goal.

His key recommendation to improve drug discovery, however, was to put more information in the public domain. "Open access science" minimizes duplication, makes it easier to work with the best people (*i.e.* no complex legal negotiations around sharing information), and avoids the patent thickets that cripple researchers' freedom to operate. Dr. Edwards' own open access project—The Structural Genomics Consortium—offers a model of how to operate. The SGC is a research partnership between academia and industry. It is located in a university to provide independence and legitimacy; funded by the public and private sectors; has well-defined objectives; and puts all results into the public domain. The net effect is to create a space within which researchers and organizations can collaborate to increase the aggregate level of knowledge in pioneer areas of science. Industry can then launch proprietary drug discovery efforts with less chance of failure.

Dr. Edwards closed by noting the importance of effective regulation to enabling a competitive biotechnology industry in Canada. We could do a better job, he said, in bringing together regulators and the research community. He pointed to the Inter-State Regulatory Council in the U.S. as an example of a structure that helps align regulators with the scientific community. Finally, he argued that one of the key underlying factors inhibiting Canada from becoming a leading bio-based economy is that Canadians are complacent and risk averse: "every time a company fails," he said, "it's somebody else's fault."

PANEL DISCUSSION: *WEATHERING THE STORM/ LAYING THE GROUNDWORK*

This panel provided a range of perspectives on the current state of the bio-based economy, including how specific sectors are responding to the economic downturn as well as laying the groundwork for the future. Moderator **Ian McTiernan (Assistant Vice-President-Research, University of Toronto)** introduced the discussion by noting that despite the bio-based economy's impressive platform, there is a sense of anxiety among biotech

stakeholders around the sustainability of the sector. He suggested that that the extent of the bio-based economy—which crosses a range of sectors of the economy—means that it is taken for granted.

Peter Matthewman (President and CEO, Performance Plants) provided a sobering look at the survival issues facing a large number of biotech companies in the near term: twenty-five percent of Canadian biotech companies are currently out of money, and fully fifty percent will be out of cash by the end of the year. Many are laying off staff, and all are looking for a portfolio of funding sources beyond venture capital. The long-term opportunities for biotechnology with respect to food and fuel are significant, however. Global population growth is putting pressure on food and water supplies, and climate change is driving a push for more sustainable forms of energy production. Technology will be crucial, Mr. Matthewman said, in supporting a growing population that aspires to rising living standards, while managing the environmental impacts. One example is the possibility of using plants' own genes to protect themselves from environmental stresses, such as heat or lack of water.

The catch is that this kind of research is lengthy, expensive, and subject to high regulatory barriers. The main dilemma facing biotech companies, according to Mr. Matthewman, is that they rely on short-term capital to finance these long-term processes. There are useful programs at the federal and provincial levels, but they need to move faster, Mr. Matthewman suggested. Looking ahead, he recommended, first, that biotech companies should be able to monetize tax losses for domestic activities (*e.g.* flow through tax credits); and second, that governments should provide incentives to invest in Canadian intellectual property.

The renewable fuels industry has been bombarded with negative press in recent months, acknowledged **Tim Haig (President and CEO, BIOX Corporation)**, alluding to the food versus fuel debate. However, he maintained that the bio-fuels industry is on the cusp of three "positive vortexes" in Canada, around innovation, energy, and agriculture. The industry currently generates 10,000 jobs and $600-million in additional wealth, and with current policy structures these numbers are expected to rise. Public opinion polls indicate support for bio-fuels, including the mandatory inclusion of ethanol in the fuel pool. The next step is to move to "next generation" bio-fuels, which are non food-based. In order to get there, Mr. Haig argued for continued market access, in the form of an ongoing mandatory inclusion of ethanol and bio-diesel in the fuel pool. He pointed to Brazil's 25 percent mandatory of ethanol in their fuel pool, which has allowed that country to reduce its imports of fossil fuels. Second, the bio-fuel industry needs measures to help ensure it can compete with imported products (*e.g.* comparable tax treatment); this will help generate the wealth that will incentivize companies to move forward into next generation bio-fuel technologies.

The goal of the University of Western Ontario Research Park's new campus in Sarnia is to help integrate renewable resources into existing value chains to create a bio-economy cluster, according to **Joel Adams (Executive Director, UWO Research Park)**. The new campus will bridge sectors in which Ontario has traditional strengths, by linking one of the largest petro-

chemical complexes in North America with one of the most fertile agricultural regions, as well as being in close proximity to high-tech clusters and forestry head offices. This would help transform and reinvigorate traditional industry in southern Ontario. One of the challenges, however, is to ensure that large industry receptors in traditional sectors (automotive, chemicals, plastics) that will eventually deploy biotechnology are preserved. One of the lessons of the experience of the UWO research park is the importance of local leadership and "seed" funding from local communities and firms, which can then be leveraged into greater funding. Another is the urgency of action and that there is no need to "reinvent the wheel" in doing so.

Hadi Salah, (Analyst, Frost & Sullivan) provided a global perspective on the life sciences industries. The rise of East Asian economies, in particular, is transforming the biotech landscape. India is home to pharmaceutical companies with a global presence. Both it and China are becoming preferred destinations for R&D outsourcing. And favourable investment policies have made Singapore a manufacturing hub and the location of Asia-Pacific headquarters for a number of major pharmaceutical companies. Meanwhile, Brazil and Argentina are also emerging as promising markets for R&D outsourcing. All of which underscores the competitive pressures on the Canadian biotech sector, and the need to remain innovative in order to thrive. The key to innovation, Mr. Salah said, is collaboration.

In discussion, participants returned to the question of the business culture in Canada. We heard that there is more to innovation than funding university labs. The challenge is to get good ideas out of the lab, across the "valley of death" (*i.e.* the gulf between discovery and product) and into the market. Money does not follow the idea, several participants agreed, but the management. And what we do not have in Canada, according to one participant, is enough people that can take a new idea and inspire people to invest in it. The Canadian mentality is "shockingly understated," they said: we need to a better job celebrating entrepreneurship and allowing entrepreneurs the opportunities to learn from their failures.

Participants also discussed whether the public sector should invest more in the "demand" side of the innovation chain. Currently, public funding is focused on the supply side of the equation, *i.e.* funding research, while commercialization funding is focused on technology transfer offices. One participant suggested shifting more funding to entrepreneurs and the private sector; another noted the importance of public seed funding from organizations such as Sustainable Development Technology Canada. Appropriately enough, however, Question Period and the Public Accounts Committee act as significant disincentives to government risk-taking with public funds.

ARMCHAIR DISCUSSION: *THE ROLE OF THE BIO-BASED ECONOMY IN CONTRIBUTING TO ECONOMIC GROWTH AND RECOVERY*

The luncheon "armchair discussion" focused on the role of the bio-based economy–and of science, technology, and innovation more broadly—in contributing to economic recovery and growth. Moderator **David Crane (Global Issues Columnist and Author)** set the context

for the discussion by pointing out that the discussion in Canada around maintaining a competitive advantage in biotechnology goes back at least twenty years. If anything has changed, it could be that the stakes are now higher: Mr. Crane noted that, according to the OECD, by 2015 half of global production of the major food, feed and industrial feedstock crops is likely to come from plant varieties developed using one or more types of biotechnology, while in health it will no longer be meaningful to separate the pharmaceutical sector from the health biotechnology sector.

The potential for the bio-economy in Canada is huge, according to **Dr. Albert Friesen (President and CEO, Medicure Inc.)**, but two related obstacles stand in the way of Canada seizing this opportunity. One is commercialization, or the translation of discoveries into new products and enterprises. Canadian researchers are top-notch, but many discoveries made by or in Canadian universities do not end being commercialized here; insulin is but one example. The second is the venture capital environment in Canada. Canadian entrepreneurs have less access to venture capital than their counterparts in the United States; and when they do find investors, the "runway" that Canadian entrepreneurs are given tends to be much shorter—meaning that investors pull out if the venture is not immediately successful (this dynamic also acts as an incentive to sell off companies once investors' initial investment has paid off). In the United States, Dr. Friesen suggested, entrepreneurs are given the opportunity to fail and try again. He pointed to the example of Gilead Sciences, which went through several rounds of financing before turning a profit.

Several speakers emphasized that the current recession provides an opportunity to think creatively about how a bio-based economy could transform the manufacturing sector in Canada to become more competitive and sustainable. **Professor Amar Mohanty (Premier's Research Chair in Biomaterials and Transportation, University of Guelph)** argued that the key is to integrate bio-materials into traditional manufacturing value chains. In addition to powering vehicles with bio-fuels, this will mean using natural fibres in plastics, chemicals, and materials. The Ontario BioAuto Council plays an important catalyzing role in this process. According to **Dr. Bernard West (Chair, Ontario BioAuto Council)**, the Council helps companies bridge the "valley of death" with commercialization funding for bio-products that are ready to be integrated into the automotive and other sectors. Car seats made of out soy are just one example of how bio-materials from farms and forests are moving into the manufacturing sector. Other jurisdictions, including Michigan, Japan and Germany have expressed interest in the Council's mandate and approach.

Governments are increasingly looking at ways to leverage public investments in science and technology into innovative economic activity and knowledge economy jobs. In her presentation, **Margaret McCuaig-Johnston (Executive Vice-President, NSERC)** noted that in addition to funding basic and focused research, the Natural Sciences and Engineering Council is focused on helping transfer research to the marketplace. For example, NSERC supports collaborative initiatives between academia and industry, such as a forestry sector R&D initiative that funds academic research into forest bio-products on priorities identified by industry. They support a series of networks funded in conjunction with the Networks of Centres of Excellence on industrial innovation, advanced foods and materials, and green

chemistry. NSERC also supports the innovation process by funding beta trials and marketing plans for companies trying to bring an idea to marketplace. And NSERC recently changed their intellectual property policy to provide industry partners with a range of IP options, from joint ownership and non-exclusive licensing, to open access.

The discussion period returned to the question of the challenges facing the business culture in Canada, and the implications for the biotech sector. There was agreement that the venture capital environment in Canada is challenging for start-up companies, though there was debate about whether the problem is one of supply or demand. In other words, is there not enough venture capital because there are too few attractive opportunities for investment? Participants discussed in this context whether a lack of management expertise in Canada was hindering new start-ups.[5] Or is the problem that, as one participant suggested, that there is a lack of experience among people running venture capital funds?[6] Beyond the question of how to improve the conditions to support entrepreneurship and start-up biotech companies in Canada, there is also a need to encourage established firms across a range of sectors to use bio-based materials and products. Even here, however, there was a sense that smaller companies would likely lead the way.

If an innate conservatism and risk averse business culture are holding back the biotech sector in Canada, we heard that broader forces may prod Canadians out of their complacency. One is the growing competitive pressures from emerging economies that are increasingly turning to high value-added activities. This will make the global economy a much tougher place for Canada. Fear may drive us to take risks and develop new activities to replace a shrinking traditional manufacturing base. Another is that the 21st century's challenges—such as climate change and resource availability—will demand innovative responses if we are to maintain our quality of life.

TABLE DISCUSSIONS: *BUILDING THE WORLD'S LEADING BIO-BASED ECONOMY*

In the afternoon, participants were given the opportunity to engage each other in discussion around the question of how Canada can build a world-class bio-based economy.

Peter Brenders, (President and CEO, BIOTECanada) set the context for the table discussions with a summary of BIOTECanada's recently released blueprint document *Beyond Moose and Mountains: Building the World's Leading Bio-Based Economy*, which sets out a Canadian Path involving people, capital, and the operating environment. The question driving the strategy, he said, is whether Canadians want to rely on natural resources for prosperity, or do they want more? *Beyond Moose and Mountains* makes the case for being bold: that is, harnessing Canada's resource endowment to build the world's leading bio-based economy by 2020. In order to reach that goal, the document—which was based on a cross-country consultation with industry and external stakeholders—recommends focusing

[5] See, e.g. *Management matters*, Working Paper 12, Institute for Competitiveness and Prosperity, March 2009.
[6] On this topic see, *Innovation and Business Strategy: Why Canada Falls Short* (Report in Focus), Council of Canadian Academies, April 2009, pp. 15-16.

on three areas. First, the operating environment should encourage innovation. Second, education and immigration policies need to attract and retain the right people, and provide them with the necessary skills. And third, with respect to capital, we need to create a venture capital environment in which biotech entrepreneurs can succeed. We need to start, Mr. Brenders said, by aligning all stakeholders behind the long-term vision of where we want the Canadian economy to go.

Participants were asked to consider the following three questions in table discussions:

1. What is your reaction to *Beyond Moose and Mountains: Building the World's Leading Bio-Based Economy*?
2. What are the three priority actions needed to move the bio-economy forward?
3. What will you (individually) take back to your day job to move this agenda forward?

Reactions

Participants expressed support for many of the ideas in the document, with some reservations and qualifications. Many participants thought the document was a good start in that it appropriately captured the urgency of the situation facing the biotech sector and the Canadian economy writ large. There was support for the idea of coming out with a bold statement and a stretch goal. And there was general agreement on the three key areas of action identified in the document.

There was a sense among some participants of déjà vu, or "we've been here before." This sense, combined with the observation that the document is somewhat broad, prompted some participants to suggest that the challenge remains to identify and undertake concrete actions to move the agenda forward. "We don't need another white paper," according to one participant, "we need action."

Participants also raised some definitional questions about the extent to which the document adequately defines and speaks to the "bio-based economy", as opposed to "biotechnology". One suggestion was that the blueprint could more clearly map out the commonalities and differences across various parts of the bio-economy, make the case for a common approach, and identify priority actions.

Priority Actions

The definitional issue re-surfaced in participants' responses to the second question around identifying priorities going forward. Participants echoed panelists' remarks from the morning that the breadth of the bio-economy is a strength in that it provides a substantial platform for growth, but is also a weakness in that the bio-economy is spread out across various sectors of the economy, which makes it less visible and cohesive. One of the clear messages that came out of the table discussions is the need for more effective collaboration and information sharing across all parts of the bio-economy in order to identify common challenges and a unified approach toward solving them. Many participants spoke of the

need to break out of the internal silos within the bio-economy—across bio-fuels, agriculture, bio-materials and pharmaceuticals. Some suggested that work remains to be done in uniting stakeholders around a leader (such as BIOTECanada) that could advance their common agenda. "We need to figure out who we are, where we want to go, and then work together rather than compete," according to one participant. If there is debate internally about how the bio-economy fits together, they said, how can stakeholders expect to adequately convey their message externally?

If the first step is to align industry around a common vision, the next step is to align other stakeholders around this vision. Participants thus also felt that greater collaboration is needed across all sectors of society, in order to advance the bio-economy agenda. Many spoke of the need for better linkages and communication across government, industry, and academia—to break down silos, and help address the commercialization gap. One even recommended the creation of a federal department of science.

In addition to emphasizing the importance of effective collaboration, participants also had a number of specific recommendations that apply across the spectrum of the bio-based economy:

- Several participants suggested governments should support innovative Canadian bio-products through *strategic procurement*.
- There were also several comments about *intellectual property*: some suggested that more thought should be given to the merits of open source research; others recommended that a broader range of IP options should be considered in order to incentivize the commercialization of research.
- The *venture capital* crisis in Canada, particularly for the biotech sector, prompted the suggestion that Canada, like other countries, should have a national venture capital fund.
- Others suggested that the *regulatory environment* for biotech products needed to be more nimble. One table reported that they did not think regulatory changes were needed, but that the existing regulations need to move faster.
- Many participants noted the importance of *human capital*; that is, of educating, training, attracting and retaining people to work in the bio-based economy. Some thought that this should include a renewed focus in Canada's education systems not only on science, but also on entrepreneurship. We heard that Canada needs to develop management expertise in bringing biotech products to market.

Key Messages

Participants reported a broad range of key messages that they would take away from the discussion—and many returned to earlier themes such as education, collaboration and the need for political leadership. Pulling all these threads together was a common message that the bio-based economy "needs a narrative"; that is, an outreach strategy to tell the story of the bio-based economy and celebrate its successes. The thinking was that this would help

define and galvanize the sector internally, generate a culture of appreciation for entrepreneurship in Canada, and attract people and investment.

CLOSING REMARKS: *INNOVATION AND THE KNOWLEDGE ECONOMY*

In his closing remarks, **Paul Wells (Senior Columnist, MacLean's Magazine)**, picked up on the recurring theme of the need to develop a more robust business culture of innovation in Canada.

Mr. Wells began by noting the shift in emphasis among those who follow Canada's innovation performance from the *supply* of innovation, to the *demand* for innovation. Over the past decade, governments across Canada have re-invested in the front end of the innovation supply chain, by funding research in university labs. Canada is now second in the OECD in government-funded university research, per capita. Business expenditure on R&D, however, is not as strong: Canada ranks 14th out of 20 peer OECD countries on this measure. Wells acknowledged that biotechnology companies in Canada are in fact a source of relative strength in this area. The R&D intensity of the pharmaceutical industry, for example, has increased significantly since the late 1980s.[7] In keeping with the conclusion from the recent Council of Canadian Academies report on business innovation, Wells contended that Canada's poor innovation and productivity growth performance is the result of the business culture in Canada—in other words, a lack of business demand for innovation, not a lack of cutting-edge research coming out of university labs.

The need for Canada to improve its productivity growth will be more acute going forward, he noted, as economists predict that there will be less potential for total global economic growth coming out of the recession than there was prior to it. Productivity will be critical to capitalizing on whatever growth the Canadian economy does experience.

Mr. Wells offered two suggestions to shake the culture of complacency in Canada. The "stick" is increased competition, both internally and internationally. Companies across Canada should encourage provincial premiers to continue lowering internal trade barriers; and they should support Canada's negotiations with the European Union on a new economic partnership, which will go deeper than NAFTA in terms of procurement, labour mobility, and regulatory convergence. The "carrot" would be greater public reward and recognition for those companies that decide they are going to take a global perspective and an export orientation—beyond North America.

[7] Though the pharmaceutical industry's share of GDP in Canada has not grown. See, *Innovation and Business Strategy: Why Canada Falls Short*, Report in Focus, p. 22.

ANNEX 1 – AGENDA

Roundtable on the Future of the Bio-Based Economy in Canada

May 11th 2009
9:30 am – 4:00 pm
National Arts Centre, Panorama Room
Ottawa

Agenda

The bio-based economy is a driver of innovation and key contributor to Canada's social, economic, and environmental well-being, through the application of biological tools and processes to the production of food, energy, chemicals, treatments, diagnostics, and materials. Yet, it faces a number of challenges, including attracting investment, commercializing new technologies, and attracting and retaining qualified workers. Meanwhile, other countries are investing aggressively in biotechnology, pioneering innovative partnerships between industry and academia, and building the fiscal and regulatory environments in which biotechnology can flourish.

This roundtable will convene experts from industry, academia, and governments for a multi-stakeholder dialogue on the opportunities and challenges facing the bio-based economy in Canada. Expert speakers in the morning will set the stage for a deliberative session in which participants will consider the framework proposed in BIOTECanada's strategy document *Beyond Moose and Mountains: Building the World's Leading Bio-Based Economy*, as a starting point for discussion.

9:30 a.m. Registration and coffee

10:00 am **Welcoming Remarks**
- **Linda Kristal**, Vice-President, Public Affairs, **Public Policy Forum**

10:10 – 10:40am **Opening Presentation**
- **Dr. Aled Edwards**, Director, **The Structural Genomics Consortium**/ Banbury Chair of Medical Research, Banting and Best Department of Medical Research, **University of Toronto**

10:45am – 12:15pm **Panel Discussion—*Weathering the Storm/ Laying the Groundwork for the Future***

This panel will provide a range of perspectives on the current state of the bio-based economy both in Canada and globally. Speakers will address how specific sectors are responding to the economic downturn as well as laying the groundwork for the future.

Speakers:
- **Timothy R. Haig**, President and CEO, **BIOX Corporation**

- **Peter Matthewman**, President, **Performance Plants**
- **Joel Adams**, Director, **The University of Western Ontario Research & Development Park**
- **Hadi Salah,** Industry Analyst, **Frost & Sullivan**

- **Tim McTiernan**, Assistant Vice-President, Research/ Executive Director, The Innovations Group, **University of Toronto (*moderator*)**

12:15 – 1:30pm Lunch

12:45 – 1:30pm **Luncheon Armchair Discussion**

An armchair discussion among leaders from government, academia and the business community on the role of the bio-based economy –and of science, technology, and innovation more broadly—in contributing to economic recovery and growth.

Speakers:

- **Dr. Albert D. Friesen**, President and CEO, **Medicure**
- **Margaret McCuaig-Johnston**, Executive Vice-President, **National Sciences and Engineering Research Council**
- **Prof. Amar Mohanty,** Premier's Research Chair in Biomaterials and Transportation**, University of Guelph**
- **Dr. Bernard West**, Chair, **Ontario BioAuto Council**
- **David Crane**, Global Issues Columnist and Author, **(*moderator*)**

1:45 – 3:30pm **Table Discussions—*Building the World's Leading Bio-Based Economy***

In table discussions, participants will discuss, problem-solve, and generate practical ideas to build a leading bio-based economy in Canada.

Opening presentation

- **Peter Brenders**, President and CEO, **BIOTECanada**

Facilitator

- **Don Lenihan**, Chair in Public Engagement, **Public Policy Forum**

3:30pm **Rapporteur**

- **Paul Wells**, National Columnist, **MacLean's Magazine**

3:45pm **Closing Remarks**

- **Linda Kristal**, Vice-President, Public Affairs, **Public Policy Forum**

4:00pm Adjourn

ANNEX 2 – PARTICIPANT LIST

ROUNDTABLE ON THE FUTURE OF THE BIO-BASED ECONOMY IN CANADA

May 11th, 2009
Ottawa

Speakers

Mr. Joel Adams
Director
The University of Western Ontario Research and Development Park

Mr. Peter Brenders
President and Chief Executive Officer
BIOTECanada

Mr. David Crane
Global Issues Columnist and Author

Dr. Aled Edwards
Chief Executive Officer
Structural Genomics Consortium
University of Toronto

Dr. Albert Friesen
President and Chief Executive Officer
Medicure Inc

Mr. Tim Haig
President and Chief Executive Officer
BIOX Corporation

Mr. Peter Matthewman
Chief Executive Officer
Performance Plants Inc

Ms. Margaret McCuaig-Johnston
Executive Vice-President
Natural Sciences and Engineering Research Council of Canada

Mr. Tim McTiernan
Assistant Vice-President,
Research and Executive Director,
Innovations Group
University of Toronto

Professor Amar Mohanty
Premier's Research Chair
Biomaterials and Transportation
University of Guelph

Mr. Hadi Salah
Industry Analyst
Technical Insights
Frost and Sullivan

Mr. Paul Wells
Senior Columnist
Maclean's Magazine

Dr. Bernard West
Chair
Ontario BioAuto Council

Participants

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Earnscliffe Strategy Group

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Chairman and Vice President
Health & Pharmaceuticals
Global Public Affairs

Ms. Betsy Bascom
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