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INTERNATIONAL REVIEW PANEL REPORT

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CANADIAN INSTITUTES OF HEALTH RESEARCH

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I would also like to thank the members of the 13 Expert Review Teams (ERT) for their valuable contributions to this process. The reviews of the 13 Institutes, which took place in February 2011, played a key role in the success of this review process. The ERT provided the IRP with a comprehensive assessment of the scope of each Institute's mandate, activities and impact on the Canadian landscape in their respective areas of research. I especially would like to thank those members of the IRP who participated in both the ERT meetings in February and the March review meetings. The Review benefited greatly from your dedication and commitment. The key stakeholders who met with the panel also need to be acknowledged for their participation in the Institute and IRP meetings – their contribution was invaluable and helped to add precision to the evaluation.

Ultimately, this review process was a success because of the dedication and commitment of all those involved. My fellow members of the IRP and the ERTs responded to their tasks with energy, diligence and good nature throughout what was a very intensive process. Their contributions were significant.

It has been an honour and a privilege to lead the Review of this premier research organization. Through research, the panel is confident that CIHR will continue to have a transformative effect on the health of the nation.

Elias Zerhouni, MD
Chair, International Review Panel

Executive Summary

The Canadian Institutes of Health Research (CIHR) was created 10 years ago with the bold goal of improving the health of all Canadians through excellence in health research. The depth and breadth of CIHR's responsibilities require that the agency be both versatile and focused. In 2006, the International Review Panel (IRP) concluded that the newly established agency was, in the short time since its inception, well on its way to meeting its mandate. Since 2006, CIHR has made many significant improvements, including the creation of a Scientific Council, the empowerment of and collaboration between the Scientific Directors (SDs) of the 13 Institutes, and a strengthened executive management team.

As part of this 2011 IRP review, each of the Institutes underwent a mandate-specific review, which reinforced the general view that CIHR is enjoying significant success. It was noted that the Scientific Directors were meeting their mandate to catalyze research, and convene and create productive research partnerships between investigators and among Institutes. Although the IRP considers the current slate of mandate-specific Institutes to be appropriate, the IRP noted the importance of a periodic review of the composition of the Institutes to ensure that emerging areas of science and public health needs are met over time.

The Panel was particularly concerned about the complexity and lack of coordination at the federal and provincial levels of the many different types and sources of funding which support the research enterprise in Canada. Although these issues are not under the direct purview of CIHR and its leadership, the Panel strongly recommends that these be considered and addressed at the national level to ensure that CIHR can reach its goals. In particular, the Panel noted the challenges faced by CIHR in reporting through the Minister of Health, while virtually all other important components and programs fall under the purview of the Minister of Industry. CIHR is, however, an important contributor to the development of health policy in Canada and the current reporting structure under the Minister of Health is appropriate.

CIHR's peer review system, which must serve the diverse science and research workforce, is critical to the success of the agency. The peer review system is currently under review and improvements are underway. Nevertheless, the proliferation of committees and reviewers needs immediate attention to ensure the continued health of the process. In addition, the IRP suggests that strategic changes to the grants policy, such as awarding larger and longer grants and creating a regular and more formal process for research program portfolio planning, would enhance the efficient and effective performance of the research enterprise in Canada

The 2011 IRP reiterates the recommendation of the 2006 Panel in calling for the creation and collection of objective and substantive metrics and data at all levels of the enterprise. Such efforts will help ensure that future reviews of CIHR activities are based on a comprehensive data set, thereby informing future course corrections and resource allocations.

The Panel notes that while Canada has a substantial reputation in health research, the translation of Canadian science into products and services that can sustain the competitiveness of Canada is falling short. To this end, CIHR should take the lead in developing and implementing policies and incentives for scientists and institutions to enhance the entrepreneurial spirit in Canadian health research.

Since the last IRP report, CIHR has made great strides in fostering engagement with the public; however, a more concentrated effort is required, especially with regard to voluntary organizations. Such effort should be divided between central strategies and those which are mission-specific and would be better addressed by the Institutes.

Canada's deep interest and long-standing activities in clinical research need constant nurturing. There is a growing need for centralized cores for data management and analysis, statistics and computation, bio- and health-informatics, etc. With this in mind, the proposed CIHR Strategy for Patient-Oriented Research holds great promise in addressing many of these challenges.

With regard to basic science, new emphasis should be placed on multi-disciplinary research, including mathematics, physics, computer science, engineering, material science, and social sciences. And as the enterprise grows, policies and procedures also need to be created and implemented to facilitate data storage, high-performance computing, and data visualization. Currently, such issues are not high on CIHR's research agenda.

The research workforce is clearly a priority for CIHR. Young investigators and clinical scientists, in particular, need viable career paths to ensure they are recruited into research careers and retained as leaders and role models for the next generation. To this end, efforts are needed to encourage academic institutions to carve out time from teaching and clinical services to devote to research.

Finally, the Panel commends the President for his leadership in developing CIHR into a highly effective organization. It is important as CIHR grows that the President has the resources, human and fiscal, to accomplish the agency's diverse mandates and missions.

Our review has resulted in the following recommendations:

- *The Governing Council should form a working group to periodically (every 3-5 years) examine whether the slate of CIHR Institutes is appropriate.*

- *Major Canadian funding agencies, the relevant federal funding departments, the provincial system and the university sector in Canada should make the necessary structural and process changes to streamline the current complex system for funding infrastructure, salaries and indirect costs.*

- *CIHR should consider awarding larger grants with longer terms for the leading investigators nationally. It should also consolidate grants committees to reduce their number and give them each a broader remit of scientific review, thereby limiting the load and ensuring full attention to new highly meritorious proposals.*

- *Conduct regular and comprehensive planning efforts to define and prioritize targeted research areas and create and promulgate research announcements aligning with these priorities. Consider creating a Common Fund from which some of such announcements could/should be funded.*

- *CIHR should develop a comprehensive set of metrics and robust evaluation strategy as a means of regular review of CIHR by both the agency's leadership and future international review panels.*

- *Enhance industry relationships and opportunities for Canada by encouraging symbiotic collaborations at the investigator, institute, university and federal government levels. CIHR should clearly emphasize as a major strategic orientation the creation of novel career paths allowing flexible interconnections between academic and private positions.*

- *Expand the breadth of the members of the Governing Council to include public members. The formation of a parallel advisory structure that would enlarge the participation of voluntary organizations may also be considered.*

- *CIHR should explore methods for increasing public and patient participation/input in all its processes from prioritization, through advising on appropriate study endpoints and funding decisions to trial steering groups.*

- *Create a CIHR Office of Public and Government Affairs that serves "corporate" CIHR but is also staffed to help SDs with Institute-specific communication needs and/or issues. This Office would also lead communication efforts with various government agencies and Parliament.*

- *Create programs that are sustainable and can work over time to improve knowledge translation between researchers, their institutions, CIHR and the public at all levels.*

- *CIHR should lead a Canada-wide effort to harmonize data sets and enable national linkages which would benefit <u>all</u> CIHR institutes and the Canadian research enterprise at large.*

- *Establish Canadian Centres of Excellence of Clinical and Translational Research, which will develop the critical mass of scientists coupled with research infrastructure (horizontal integration) to expedite the advancement of basic discoveries to human application, impact clinical practice, and community health. Implement the Strategy for Patient-Oriented Research.*

- *Provide sufficient funding for randomized controlled trials to ensure adequate sample size and statistical power. In view of current budget constraints, it will be important for CIHR to prioritize and only select trials with high potential impact. One effective approach to reduce cost is to develop international partnerships and collaborations.*

- *CIHR should catalyze new areas of research that are beyond its current knowledge domains, including the domains of mathematics, physics, computer and materials sciences, bioinformatics and certain engineering disciplines such as bioengineering. Strategic cooperation with other partners, e.g. Genome Canada or NSERC, should be considered in order to facilitate the development of a national bioinformatics strategy. Other areas such as human ecology, operations research or the study of complexity in general might be worth exploring.*

- *CIHR should work with the nation's universities to enhance the career paths of its young investigators. Particular attention should be paid to clinical investigators who must balance clinical service obligations with research.*

- *CIHR's President should create a position of Deputy Director for Operations and Management. Given the need to now look more externally to better engage other agencies of government at federal and provincial levels, to represent CIHR to its many stakeholders, to create new national and international partnerships, and to raise the profile and influence of CIHR nationally, this position would free the President to give more attention to these needs, especially since he has stabilized the organization and established good internal processes.*

Introduction

The Canadian Institutes of Health Research was created 10 years ago. It was designed to support the entire gamut of health research – from basic biomedical research through to health services research. As stated in its creation, the new organization was "To excel, according to internationally accepted standards of scientific excellence in the creation of new knowledge and its translation into improved health for Canadians, more effective health services and products, and a strengthened Canadian health-care system."[1] Given this mandate, CIHR's research mission is both broad and deep and brings both advantages and challenges to the Canadian research enterprise and its researchers.

CIHR is comprised of thirteen thematic Institutes devoted to specific areas of science, disease and human development. In one of its most unusual constructs, the Institutes are virtual, in that there is no bricks-and-mortar location for their activities. Institute directors run these virtual Institutes from their home institutions with modest budgets and the cooperation and enthusiasm of researchers across the country.

The funding of research in Canada is complex. CIHR funds research projects through the awarding of grants, while other entities are responsible for funding salaries, infrastructure, and indirect costs. In this environment, CIHR must balance investigator-initiated grants with targeted funding.

CIHR reports to Parliament through the Minister of Health and is part of Canada's health portfolio.[2] It is governed by a Governing Council (GC) appointed by the Governor General of Canada on the advice of the Queen's Privy Council of Canada (i.e. the Cabinet). This advisory entity is responsible for overarching issues, including strategic directions, budget and evaluation. The President is both CEO of CIHR and the Chair of the Governing Council. CIHR's President is advised on science strategy via the Scientific Council, which is made up of the Scientific Directors (SDs) of the thirteen Institutes, CIHR's Vice Presidents, the Director of Ethics, and two non-voting members, the Chief of Research Operations and the Director, Marketing and Communications.

CIHR was designed to replace the Medical Research Council (MRC) of Canada and, as such, was seen as a bold new vision for research and for the health of the nation's citizens. The first review of CIHR took place in June 2006.[3]

Evolution: Update on the 2006 International Panel Review

By 2006, CIHR was in an early stage of its rapid evolution from the Medical Research Council. It had already transformed health research in Canada and energized the entire landscape. A range of innovative activities and cross-disciplinary collaborations were already evident. The major changes, which involved broadening the focus of the MRC into CIHR pillars to include more clinical research and to bring in population health and health services research, were felt to be on track and effectively changing the culture. At that time, it was premature to judge the

effectiveness of the new funding model, as objective outputs were not yet available, but it was very clear that the thirteen Institutes were all functioning well, mostly due to the caliber and passion of the SDs.

Since 2006, CIHR has made many significant improvements based on the evolution of the Agency and the advice of the first International Review Panel.[3]

In response to the 2006 IRP's recommendations, the governance structure for research has been significantly improved. The Governing Council is now responsible for setting overall strategic directions for CIHR and approving its budget reports to the Minister of Health. The mission and function of the Governing Council have been improved by the current CIHR President. As suggested by the 2006 IRP, the Scientific Council, which is made up of the thirteen SDs, is providing scientific leadership and advice to the GC on health research, knowledge transfer priorities, and strategies in accordance with the overall strategic directions set by the GC.

The current construct appropriately empowers the SDs to manage and set priorities for their own Institutes, as well as playing a role in decisions related to the appropriate balance of targeted vs. investigator-initiated funding. Importantly, the SDs report that they now function with greater confidence, autonomy, and authority. At the same time, autonomy has not produced a silo mentality. The SDs appear to be working together as an enthusiastic and collaborative team. They exude a sense of pride in their achievements, of knowing what their roles are, whilst acknowledging that they all work "150%." This certainly gives the impression that this "experiment" in restructuring the old MRC into these thirteen CIHR Institutes has been very successful and is transforming Canadian health research. Recently and importantly, the current CIHR President is focusing on better defining priorities through a Roadmap process, which is to be commended.

The IRP noted that although more central support for the SDs is being provided, many still report a need for more staff. The virtual nature of the Institutes makes this a challenge, but some increase in support is crucial, especially since the SDs are all expected to maintain world-class research in their own labs while running the Institutes. Some of these concerns may reflect a variable amount of support from the SD's home institutions. It was not clear to the Panel whether the universities, which host the Institutes, view this role as prestigious or indeed as something that warrants their support. It was unclear whether they get adequate national recognition for hosting an Institute.

The increase in core resources to $8.5M per Institute is also a good step in the right direction, empowering Institutes and giving them the means to collaborate with each other (see below), a trend that is clearly evident and welcome.

Since 2006, there has also been a successful effort to strengthen the executive management team. These new positions are improving CIHR's capacity to better coordinate the core functions of the agency. There has also been improved accountability and transparency across the whole of CIHR.

The challenges observed in 2006 relative to matrix management functions, both across the Institutes and with central CIHR, have improved (see Expert Review Team reports for individual Institutes, at www.cihr-irsc.gc.ca/e/31680.html. The increased annual allocation to individual Institutes (from around only $1M at the commencement of CIHR to $8.5M currently) is being

used very effectively to address these matrix challenges. There are numerous examples of cross-institute and "corporate" CIHR initiatives in research, training and translation, which are exciting and impressive, e.g. National Cancer Strategy and the Canadian Longitudinal Study on Aging. There is still room for improvement, however. For example, the Institute of Aboriginal Peoples' Health (IAPH) is not included in collaborations to the extent it should be, which is disappointing given the high rates of diseases and problems in this population sub-group in Canada.

Individual Institute Reviews

It is clear from a review of the Institutes conducted preparatory to the IRP review that the Institutes have made significant headway in the years since the first report. The IRP members participated in reviews of each Institute. These reviews can be found on CIHR's website, at www.cihr-irsc.gc.ca/e/31680.html. In sum, panels noted that Institutes were achieving all or part of their mandates. Because of the breadth of the Institute mandates, it was suggested that it was premature to expect some of the Institutes to be achieving their full mandate and having the degree of impact that is expected.

The high level of leadership of the SDs as champions for their respective areas is recognized by the IRP as key to the overall success of CIHR. SD transition was flagged as a potential risk, and suggestions were made concerning the breadth of Institute Advisory Board (IAB) membership. Panel members noted that Institutes were successfully transforming the research environment by acting as a catalyst, convener, and creator of networks and partnerships. Partnerships and collaborations were seen as strengths and the panels recommended continued efforts, including a focus on inter-institute partnerships.

Panels highlighted Institute achievements in research capacity development, but also noted possible risk to the sustainability of career pathways. They commended some Institutes for their knowledge transfer (KT) activities and encouraged others to strengthen such efforts. Partnerships were deemed important for research translation. Panels also recognized Institutes for their contributions to the advancement of ethical research. Institute panels took note of several areas in need of improvement, including communication and metrics, and data gathering for the purposes of evaluation.

There has also been remarkable progress in KT. Whilst the 2006 Review Panel commented that there had been some attempts at KT in infectious disease, public health and health services research, this aspect was, on the whole, poorly developed at that time. Today, there is a general feeling from most of the stakeholders and all of the SDs that KT is now better integrated into the mandate of all of CIHR's leadership. However, given Canada's great track record in evidence-based medicine, systematic reviews, participation in the Cochrane collaboration, and having a history of landmark randomized controlled trials (RCT), it is felt that many of those in provincial health services are not using the information being produced by CIHR and other research entities. They are not participating in effective two-way partnerships to enhance the impact of health research supported by CIHR. Hence, while the 2011 Panel is positive about KT in clinical and health services from the perspective of CIHR, how they work more effectively with those who need to use the evidence is now a major challenge and should be a major goal for the future. CIHR President's new Patient-Oriented Research Strategy developed in the Roadmap for CIHR may galvanize these end-users to participate in KT.[4]

In addition, there has been significant maturation in the range of ethical issues recommended by the 2006 Panel. Today's studies range from how studies are assessed ethically to research into ethics itself. Multi-site ethics approval remains a priority and must happen for efficient collaborative clinical studies across many centres.

Despite the significant progress in a number of areas raised by the 2006 Panel and the efforts of CIHR and its very able President, there remain areas in need of improvement. Some of these are within the power of the President to make changes, while others address the overall research enterprise in Canada and are not under the direct purview of CIHR and its leadership.

It is the view of the IRP that the Institutes are functioning well, and collectively they are supporting a strong and vibrant health research enterprise. The IRP considers the current slate of CIHR Institutes to be appropriate. Going forward, it is important to review the slate of Institutes to ensure that CIHR is supporting an evolving research landscape.

> ***Recommendation: Governing Council should form a working group to periodically (every 3-5 years) examine whether the slate of CIHR Institutes is appropriate.***

Structure, Governance, Coordination and Funding of Health Research

There is a complexity and lack of coordination at federal and provincial levels of the many different types and sources of funds, e.g. research salaries from universities, the Canada Research Chairs, grants from CIHR and other agencies, provincial initiatives, infrastructure from the Canada Foundation for Innovation (CFI), Genome Canada, and indirect costs from a host of sources, and similarly with training. Addressing what was described in 2006 as "a major outstanding challenge", this situation has not improved substantially since the last review. Indeed, the national funding environment has become more complex with the Canada Excellence Research Chairs, refunding of Genome Canada, the initiation of the Canada Brain Research Fund (with matching funds by Brain Canada, a registered charity[5]), Grand Challenges Canada, as well as new provincial initiatives in British Columbia (BC) and Ontario. It is clear from speaking to scientists on the ground that they find it extremely challenging to function in such a fragmented environment with so many different sources of funds to apply to for their research endeavours.

In addition, salaries and indirect costs are not aligned with operating grants, thus complicating the ability of scientists to synchronize and coordinate their support. The Panel considers this a major and continuing structural flaw in the current Canadian research enterprise.

Although the IRP recognizes that CIHR and the federal government have little control over provincial funding policies, nevertheless, the federal government itself does not appear to recognize the need for more coordination in this area. The failure to align capital (CFI), personnel (Canada Research Chairs, Canada Excellence Research Chairs) and operating grants has led to an expansion of infrastructure and positions unsupported by operating grants. This is clearly unsustainable and puts the entire system at risk. Despite the obvious and stated concerns in this regard, representatives of federal departments that spoke with the IRP seemed unconcerned about

this diffuse environment and its consequences on the whole. The IRP suggests that such silos and territoriality will not only slow the pace of research in Canada, but also have the potential to waste valuable resources.

Further adding to the complexity, health-related research in Canada falls under the purview of two different government ministries – some activities report to the Minister of Health, while others report to the Minister of Industry. CIHR reports through the Minister of Health, however virtually all other important components and programs fall under the purview of the ministry of Industry. This leaves CIHR at a disadvantage in matters of budget and in some cases matters of scientific substance. Modern research is fundamentally interdisciplinary and many breakthroughs occur at the interface of disciplines that traditionally did not interact much, such as the physical and biological sciences.

Even within a ministry, responsibilities have been divided in a way that is not conducive to effectiveness and efficiency. For example, while CIHR is responsible for funding the full gamut of health research, the Canadian Health Services Research Foundation is also responsible for funding health services research. While the work of the Canada Brain Research Fund and Genome Canada fall squarely into CIHR's research portfolio, these two entities are not under the purview of CIHR and compete with CIHR for funding. What is more, Genome Canada falls under the ministry of Industry, suggesting that it is not directly related to health and is primarily driven by economic outcomes.

While the recently approved Canada Brain Research Fund will likely share CIHR's review processes, which is good, it also risks being yet another step in the fragmentation of Canadian research instead of coordination. Regarding Genome Canada, the IRP heard that conflicts can be managed. However, Pierre Meulien, President of Genome Canada, in speaking about collaborations with CIHR and the Structural Genomics Consortium, acknowledged the long-term risks of duplication, gaps, inefficiency, and conflict among independent units with overlapping if not identical missions requires closer monitoring and could be considered a strategic concern.

Although Canadian health researchers are managing to negotiate the current laborious and complex funding system, it is difficult to see how CIHR alone can effectively coordinate or change the rather chaotic federal funding programs.

One example of the lack of coordination was evident regarding a recent decision of the Social Sciences and Humanities Research Council (SSHRC). The Council decided unilaterally to jettison their portfolio in health-related behavioural and social sciences research without consultation or necessary agreement with CIHR, which is expected to take on this added responsibility within its already constrained resources. A system that allows for science and funding to be shifted without regard to the potential impact on the field of science is concerning.

The IRP did see recent evidence of increased collaboration between the three Granting Councils (CIHR, SSHRC, and the Natural Sciences and Engineering Research Council – NSERC) in their efforts to harmonize policies and practices and to fund research at the interface of their respective mandates. The Collaborative Health Research Projects is a good example of a successful cooperative program.

CIHR does not have the authority and responsibility to fund research infrastructure. The Canada Foundation for Innovation has the mandate of funding infrastructure across all of the disciplines. CFI responds to applications by holding competitions and has funded approximately $ 5.5B during its lifespan.[6] These awards are leveraged by the institutions, provinces, and the private sector, and have resulted in $13B in capital expenditure. Competitions do not specifically target any sector, but approximately 50% has gone to the health sector. CFI has performed multiple outcome measurement studies in order to understand how its investments have supported the goals of its grant-making.

Institutions that apply to CFI have an institutional research plan that is in alignment with the application. Unfortunately, there is no guarantee that success in a CFI application will align with the awarding of operating grants. Problems of alignment are not unique to Canada, but especially for equipment grants and some renovations, the disconnect with operating grants appears to create inefficiency in a resources-constrained system and, at its worse, undercuts important infrastructure needs that must be aligned with CIHR's program goals. Furthermore, the sustainable funding of the continuous operating costs for such infrastructures is not clear and only provides for the first few years, with the remaining years being the responsibility of the recipient institutions, which do not have an explicit mechanism of indirect cost recovery. How are these investments to be sustained in the long term?

Indirect costs pose another problem in the Canadian research enterprise. Since CIHR grants do not provide associated indirect costs, universities are not fully supported for the work conducted in their institutions. University presidents had to fight to get 25% for indirect costs, but larger universities get proportionally less, with 19% provided to the University of Toronto and up to 56% for other institutions. Research-intensive universities are, in essence, disadvantaged for economies of scale.[7] Since indirect costs are inversely proportional to activities, this system ultimately discourages efficiency of the resource allocation system. Indirect costs seem to be paid at the federal or provincial level depending on the source of the research funding. Overall coordination is challenging and the system may ultimately and unintentionally undercut the strongest, most globally competitive institutions in Canada.

> ***Recommendation: Major Canadian funding agencies, the relevant federal funding departments, the provincial system and the university sector in Canada should make the necessary structural and process changes to streamline the current complex system for funding infrastructure, salaries and indirect costs.***

The ministries of Health and Industry could be charged with forming an exploratory committee to revisit the current structure with the goal of aligning for the sake of the conduct of science and health research by the entities that are performing it rather than administrative and bureaucratic imperatives. The governance and operating structure of Canadian research need not copy the organization of other countries, but a study to benchmark other national approaches to research organization at this stage in the development of the Canadian system might well position the nation for competing internationally in the next decade.

Peer Review

The Panel acknowledges that since its formation, CIHR has been working hard to set up a peer review system to serve the country and its many and diverse research workforce. In the context of such a broad mandate for CIHR and its limited resources, it is no surprise that low funding rates lead to an overload of the review system and potentially its quality. There are current plans to make significant improvements to the peer review processes, including improving the platform for recruitment and management of experts, gathering and storing electronic CVs for researchers and a research classification system that allows them to find and assign reviewers more effectively and efficiently. CIHR is also working with the Institutes to help ensure that scientists get recognized by their home institutions for their participation in peer review.

CIHR manages more than 50 review panels (~15 members/panel). These panels handle 2,300 applications, of which 400 are funded. Each committee ranks the applications, which is then converted into a percentile list and funded according to the payline. Institutes have no control over what gets funded in their mission-specific areas. Although they do monitor what gets funded in their portfolios.

The average grant award is about $140,000/year for 4-5 years. These funds do not all support operating costs, salaries, indirect costs, or large infrastructure needs. In this manner, the awarding of a grant to conduct research is not directly and immediately aligned with all of the components of the research enterprise. Researchers' salaries are supported by the universities where they are employed, except for clinical researchers who are largely supported by the hospitals where they work (see the section on Clinical and Translational Research). To this point, funded investigators reported to the IRP that they are having difficulty in aligning the resources needed once funded by CIHR as they have to "negotiate" with multiple authorities within and outside of their parent institutions to assemble and synchronize all the necessary components to accomplish their research goals.

Although some progress has been made in shaping the review structure within CIHR, it is clear that the agency still suffers from excessive complexity in its grant programs. A proliferation of grants committees to support its programs leads to a combination of confusion amongst scientists applying for grants and severe review fatigue. Previously identified in the 2006 Review as a growing issue, this remains a problem which threatens the entire system of grant funding. It is not clear how best to resolve this problem, but the proliferation of committees and reviewers suggests that they are being asked to look at too narrow a set of scientific grants and that the size of the average grant is sufficiently small that many grants need to be awarded and administered. In addition, the number of times an applicant can submit previously rejected projects is unlimited, creating potentially unnecessary "churn" and workload which may gain by being streamlined. Several new investigators pointed out that three-year grants were too short to establish a competitive program and welcomed the intent to lengthen these grants to five years.

> ***Recommendation: CIHR should consider awarding larger grants with longer terms for the leading investigators nationally. It should also consolidate grants committees to reduce their number and give them each a broader remit of scientific review, thereby limiting the load and ensuring full attention to new highly meritorious proposals.***

What is more, although it has been decided by policy that so-called investigator-initiated grants represent 70% of the research funds and targeted grants represent about 30% of the funds, the manner for deciding what targeted research to fund is not fully refined. Recognizing that CIHR may have funded too many targeted research programs in the past, a decision was recently made to reduce the number of targeted announcements to one per Institute. This is a good first step, but it begs the question of how, given constraints on resources, priorities should be set for maximum effectiveness in the future.

CIHR should lead an effort consulting both SDs and other stakeholders to decide on which research areas meet the needs of the country and match its capabilities (human and other resources). These areas should be the subject of targeted research announcements. Going one step further and to ensure that Canada can move nimbly to meet urgent and emergent needs, CIHR might set up a Common Fund where CIHR's President, with the advice of SDs and other stakeholders, can quickly set up new grant programs especially in areas of needed growth and strategic importance. Programs initiated with such a fund would need to turn over every five years so that there is a regular stream of funds available for such enabling research programs.

> ***Recommendation: Conduct regular and comprehensive planning efforts to define and prioritize targeted research areas and create and promulgate research announcements aligning with these priorities. Consider creating a Common Fund from which some of such announcements could/should be funded.***

Ideally, these targeted areas should be coordinated and synchronized across the multiple agencies funding research activities. CIHR's President is making remarkable progress in engaging these other agencies and the IRP commends his approach and encourages the development of a set of key and defining strategic initiatives that can propel Canada to leadership in selected and focused areas. The IRP supports such an approach, provided that it does not encroach upon, but synergizes and further enables investigator-initiated research funding, which should remain the mainstay of Canadian research, as it has proven itself to be a core reason for the success of Canadian research on a worldwide basis. The stated balance of 70/30 for investigator-initiated and targeted research is a good one – but only as long as, of the 70% dedicated to so-called bottom-up research, a large percentage supports new knowledge generating proposals as opposed to applied research. Given the broad mandate of CIHR and the requirement to have direct impact on health systems and translation of research, the IRP is concerned that too little attention will be paid to potentially groundbreaking basic research, which should remain a priority. Careful attention to this balance is key to the overall success of the enterprise.

The Need for Developing Rigorous Metrics and Evaluation

The 2006 Panel called for the collection of objective and substantive data for each research activity to allow an effective review of CIHR activities in the future. Although metrics are only part of any assessment of the success of research programs, they are an integral part of examining the output, guiding, and ultimately adjusting dynamically, the goals and outcomes of the national investment in research. Research metrics can be collected at the organizational level, the Institute or subject level, and the individual grant level. Research metrics are necessary to ensure

accountability and transparency, for strategic development, for performance management, and for advocacy. At the grant level, provision of data and reporting of metrics can legitimately be made a condition of any grant award in a formalized progress report framework.

Metrics cannot and should not be the only means of evaluating the success of research programs, however, they are an essential component of any evaluation and should be an integral part of all grant programs where an embedded evaluation process with transparent methodologies that are perennial in nature needs to exist to provide policy makers a long-term vision of how well the national investment is performing. This is particularly important in the development of a world-class workforce and applies to the long-term monitoring of the success of training and new investigators programs.

Evaluation metrics should be aligned to the objectives and desired outcomes of each program, Institute or project and this is generally done using a logic framework model. Data is best collected in as automated a manner as possible, e.g. using PubMed to track outputs and funding acknowledgements. If such an automated system is not in place, one should be developed to ensure uniformity and regularity of data collection. The key should be consistency over time as trend data is critical.

Specifically, the last review in 2006 suggested that detailed metrics on the outcome of each grant be maintained so that publications could be directly related and attributed to CIHR funding rather than to other sources of support, such that other outcomes of the research funding could be properly monitored and tracked. Without this data, it proved impossible for the reviewers to relate CIHR funding – compared to that from many other potential sources in Canada and abroad – to the outcomes produced by a single investigator and, without this information, many of the IRP subpanels reviewing each Institute and the main IRP found it impossible to genuinely assess the impact of CIHR on Canadian biomedical science and ultimately on its contribution to global knowledge. This serious limitation was emphasized in the last review and it is clear that this issue has not yet been dealt with in an effective way. Such data is essential for CIHR to make the case for the necessary substantial increases in funding from the federal government.

> ***Recommendation: CIHR should develop a comprehensive set of metrics and robust evaluation strategy as a means of regular review of CIHR by both the agency's leadership and future international review panels.***

Process measures should be used to monitor the award process and delivery and research system performance, e.g. response times, review times, grant success rates, time from application to Institutional Review Board agreement. Outputs to be collected should include publications and patents, career outcomes for funded investigators and for trainees. Outcomes should include both clear impacts, e.g. citing of research in guidelines production, where possible on human health or health-care delivery, as well as stories to demonstrate the impact. Output measures should also include the reporting of "leverage" by grantees and Institutes, i.e. how funds were used to stimulate activities and/or the development of public-private partnerships.

Finally, since workforce development is a prime way to measure impact, CIHR should also determine a set of metrics for its training activities, e.g. number of post-docs engaged in CIHR projects. Given the size of CIHR's workforce, it might be possible to actually track the careers of

CIHR-funded researchers and trainees. This is a challenging goal as scientists move between labs and around the world, but efforts could be undertaken to seek annual reporting by grantees pre- and post-award. Furthermore, advances in internet searches now provide a means to do so at reasonable costs.

Lastly, governments are keen to identify the economic impact of their research investments. Recently, the United Kingdom (UK), in its evaluation metrics for the Research Excellence Framework, reported a 20% factor for economic impact.[8] Although the IRP recognizes that it is extremely difficult to relate early research to ultimate economic impact, it is clear that agencies that can demonstrate in defined terms such measures of success will be more likely to justify the necessary funding increases to sustain their missions. CIHR with its limited resources and broad mandate should develop such measures to insure that it is well positioned relative to other entities in terms of federal resource allocations.

Commercialization

The health-care industry possesses unique R&D capabilities with knowledge of how to create, develop, manufacture and commercialize new diagnostics, medical devices and therapeutic agents that can ultimately reduce disease burden and total costs of health-care. Industry has a desire to partner with leading academics and clinical scientists to boost innovation and get access to patients. Although Canada has a high-quality academic system involved in health-care research, currently there is a sense that the translation of Canadian science into products and services that can sustain the competitiveness of Canada is lagging. For example there is a relative under-representation of local drug discovery research for biotech or pharmaceutical companies. On the other hand, a number of clinical trials are performed by pharmaceutical companies in Canada as part of local or global programs.

The translation of basic research findings into clinical utility can improve health care in addition to potentially create new jobs. Big pharmaceutical, biotech, medical device and diagnostic companies are currently very high on many government agendas all over the world. It appears to some observers that Canada is “terrific in research,” but “terrible in translation of findings to societal benefits” (quote from a CIHR panel member). It is important that Canada compete in this “war” for scientific talent, ideas and high-tech industry contributing to a knowledge-based economy given the increasing size of the health-care sector in the economy.

It should also be emphasized that biomedical research has long cycle times between idea and potential product revenue being created (10-15 years for a new therapeutic medicine), so funding of R&D has to be sustained in the long term to capture benefits. Furthermore, the high costs for translational biomedical research requires that attracting industrial partnerships with their associated skills and capital is a fundamental requirement for success.

A fundamental CIHR goal is to support Canadian research to allow knowledge translation into improved health care. The IRP noted however that there was not a clear policy or strategy among the group funded by CIHR to actively commercialize basic research findings that could create new high profile technology, well-paid jobs, and tax revenue income for the Canadian government. Thus, there seems to be a lack of clear policies or sufficient incentives for scientists to generate or own intellectual property to enhance the entrepreneurial Canadian ecosystem.

There were very few examples mentioned during the review about scientific examples of successful industry/CIHR research interactions. Some even expressed the view that industry relations were not of concern to CIHR as this was the mission of the agencies under the purview of other ministries and not the ministry of Health. Despite attempts in the past to develop a coherent national policy on intellectual property and technology transfer, Canada still seems to lack a defined policy. Technology transfer offices at universities have been described to operate with varying degrees of efficiency and expertise and intellectual property (IP) rights discussions were seen as a hurdle for industry collaboration.

For example, gender research, a strong area of emphasis for CIHR, had no engagement with industry in spite of the fact that increasingly unique gender aspects of disease pathophysiology and responses to treatments are seen and could represent a unique opportunity. This lack of industry relationships seemed to apply also to minority group research where geographical isolation has generated intriguing opportunities for generating genetic-based mechanistic understanding of disease pathophysiology, which could represent a novel basis for discovering therapeutic agents.

The last review focused on the need to enhance knowledge transfer and, although this has been accomplished successfully in a large number of domains such as dissemination of health relevant findings, it remains wholly undeveloped from the perspective of commercialization. The IRP was surprised both by the ambiguous attitude of some officers from federal departments and senior academics to the concept that there was a significant responsibility for federal research funds to lead to commercial opportunities that would underpin high-technology economic growth. This is clearly a significant feature of both the American and European funding structures and, indeed, contributes to some of the success that these funding organizations have had in sustaining high levels of government support. Senior Canadian academics, during the review, did not, in general, feel that this was a role for CIHR to encourage commercialization of research it funded and, that also appears to be the current position of the agency. In fact, attitudes toward industry building a commercial base from research funding almost suggested that this outcome was unseemly.

The IRP views the absence of support for commercialization and a strategy to promote it to be a significant issue to be tackled in an appropriate way by CIHR. CIHR's ability to secure ongoing increases in federal support will increasingly be linked to evidence that this investment leads to economic growth as it has been linked in other countries. This is perhaps exacerbated by the current position of CIHR under the ministry of Health and unconnected to the ministry of Industry. It is our understanding that opportunities for CIHR to interact with the ministry of Industry and that ministry's interest in medical research combine to reduce the likelihood that the government sees health research as an economic driver even though health-related industries are growing on a worldwide basis. In fact, other countries are substantially ramping up data gathering on "return on investment" to include not only direct commercialization but also cost avoidance and secondary benefits from the purchase of equipment and hiring of personnel which bolster the nation's workforce.

Health and wealth are highly interconnected. Clearly, a consensus needs to be developed around these topics realizing that scientific research cannot and should not be exclusively directed to applied outcomes but that its support by taxpayers is inherently related to the expectation of tangible benefits. With the costs of health care rising and the mission of CIHR to improve the

performance of the Canadian health system, it is imperative to ensure that innovation in doing so is encouraged. This will also require more clarity in terms of national policy and standards on technology transfer.

> ***Recommendation: Enhance industry relationships and opportunities for Canada by encouraging symbiotic collaborations at the investigator, institute, university and federal government levels. CIHR should clearly emphasize as a major strategic orientation the creation of novel career paths allowing flexible interconnections between academic and private positions.***

CIHR should make it clear that industry relations are positive, encouraged and expected (if rational) from grantees of CIHR support. Better incentives for industry relations and commercialization, i.e. benefits for renewal of future grants, scientists' career progression, and time and support for entrepreneurship activities, should be introduced. Industry facilitating metrics should be developed and applied as one key determinant of science and progress reports, e.g. granted or licensed IP, products in development or on the market.

Efforts should be made to publicize success stories or signature examples of CIHR and industry relations to illustrate for the public and politicians how taxpayers' money invested in CIHR will benefit both health care and jobs. For example, the NIH undertook a retrospective study where they looked at the most frequently prescribed drugs and tracked the scientific concepts underlying them to NIH grants. It found that virtually all of the treatments arose to some degree out of NIH-funded basic and clinical research and led to renewed congressional support for the agency.

Policies for interactions between basic scientists, health-care professionals and industry should be clarified and simplified, to the degree possible. Specifically, define a national IP strategy and benefits for R&D, and immigration laws for global talent. Solve potential conflicts of interests or culture clashes. Industry scientists should be appointed to CIHR advisory panels and peer review processes, as appropriate.

With improved industry relations from CIHR grants, Canada could transition from a relative lack of translation from basic research to successful examples of applied research for improving health care. Canada could then attract more health-care industry including big pharmaceutical R&D, foster a greater entrepreneurial spirit among its outstanding scientists, and become an even greater "start-up nation."

Communication and Engagement of the Public

The IRP reiterates the statements of the previous panel that "communication remains an important and challenging activity for CIHR." The full engagement of and participation by consumers and community is significantly underdeveloped in Canada compared with the UK, Australia, and the United States (US). For example, to address this at the highest levels, the NIH created the Council of Public Representatives, which advises the NIH Director on matters related to public engagement.

Public engagement needs to be pursued across all Institutes and at CIHR central. Some Institutes have already developed excellent approaches to engage all stakeholders. The IAPH leads the country on this aspect, but others serving non-Aboriginal agendas must also embrace the value of

more public engagement not only for KT into practice, but also for research advocacy and priority setting. Whilst most important for the clinical, population health and health services pillars, even in basic science, input from stakeholders can enhance research capacity for supporting large needs for research infrastructure, such as biobanks, longitudinal studies, and patient recruitment in clinical research.

To this point, Alan I. Leshner, President of the American Association for the Advancement of Science, recently wrote in *The Chronicle of Higher Education* recommending that institutions redefine faculty success to include public engagement. In the difficult budgetary times ahead, an "ivory tower" approach to science and its support may not be sufficient to convince policy makers of the urgency to sustain an appropriate level of research and development investments and not look at research funding as a subsidy to elite scientists but as an investment in the future of each country.[9]

CIHR and its leadership have already moved in that direction but need to further identify and appreciate the size and capacity of the public voluntary sector in health research. Many organizations such as heart or kidney foundations may have more resources and influence than CIHR in their areas. Quote from one such health charity representative to the IRP: "We fund $250M per annum for research in our area; government ignores us at their peril."

> ***Recommendation: Expand the breadth of the members of the Governing Council to include public members. The formation of a parallel advisory structure that would enlarge the participation of voluntary organizations may also be considered.***

It may also be worth a special mechanism to coordinate this better across Canada without taking away the strength and independence of these groups. For example, in Australia all National Heart Foundation grants are linked into National Health and Medical Research Council review processes, and mechanisms are in place for joined up funding proposals to address large strategic priorities or build capacity. These organizations could work more effectively with CIHR to communicate the importance of research across all four pillars, co-fund projects and equipment/infrastructure and work collaboratively for communication and KT activities (clinical, population and even commercialization).

There were several challenges around communication raised by SDs and individual researchers. There is a need to collaborate and communicate more with individual stakeholders and organizations that can use/translate/market the information as real agents of change. Efforts will need to address local, as well as national and international audiences. The model of the NIH with its "Office of Public Affairs" with greater dedicated website presence for the thematic institutes might be worth considering, in order to ensure better links between consumers, organizations, and researchers.

Many are offended by the use of the terms "sales and marketing" when it comes to science, but science must compete with other public needs including education and defense. Scientists need to champion science and to convince politicians, bureaucrats and the public that it is a great investment and we need to better communicate our challenges and successes and their tangible impact on the public. CIHR may need to re-instate the Day on the Hill and needs to take a substantive and more strategic look into how and when it communicates with all of its stakeholders.

CIHR has made great strides in fostering public engagement in the last five years. A particularly successful program is the "café scientifiques" held across the country at the initiative of each Institute. The SDs and all those who participated in this program should be congratulated for this original and successful initiative. The inclusion of representatives of patient organizations in the Institute's Advisory Boards is also a step in the right direction. The committee is pleased to see that CIHR's President is strongly considering how to further these goals which will require an enormous amount of his attention and thus may require attention to the organizational structure he currently leads (see comments on Organizational Aspects).

Informing the public of the needs and successes of health research is always a challenge. The paramount importance of biomedical research to ensure both health improvement and economic benefits is difficult to convey. Various constituencies are often competing for attention both at the local and central levels and may have conflicting agendas. Yet, effective communication is paramount for the continuing success of CIHR. Without effective communication, the public may withdraw its support for the enterprise or, as pointed out, may be tempted to support fragmented initiatives such as the new Canada Brain Research Fund or Grand Challenges Canada, at great cost to the standing of Canada on the international scene, economic benefits, and the improvement of health care for Canadians. A central goal for CIHR over the next few years should be to establish itself as the natural choice for any new health research-related initiatives so as to avoid dispersion of national efforts.

Recommendation: CIHR should explore methods for increasing public and patient participation/input in all its processes from prioritization, through advising on appropriate study endpoints and funding decisions to trial steering groups.

It is unclear that CIHR has fully succeeded in its communication mission. To ensure that CIHR speaks with one voice, the leadership has fostered a centralized model of communication that has been efficient in addressing big issues and generating a coherent message. A downside, however, is a certain frustration among the SDs, who have limited access to a minimal staff and have a desire to devise mission-specific communication strategies. The lack of ability to respond quickly and effectively to the public demand for information, and the lack of a local media team that can work closely and quickly with the SDs seems to have impaired their ability to communicate to the public, and has resulted in misinformation and some lack of confidence in the directions taken by CIHR. Clearly, with its limited resources, CIHR cannot directly influence the effective delivery of health care, but it should strive to become the authoritative voice when it comes to policies and guidelines in all aspects of health-care services.

Most importantly, communication also needs to be a priority for the CIHR leadership, as it provides the foundation for its support. CIHR's President clearly stated his intent to make communication a higher priority and the IRP fully supports these efforts. To this end, a better balance between a strong centralized communication mechanism and more distributed support for communication by each centre in their respective areas of responsibility is desirable.

In this regard, communication encompasses all levels – communication with scientists across all sectors to encourage interdisciplinary efforts; communication with patient groups for the support of science across the continuum from basic to health services; communication with other Canadian research agencies who provide some of the core support for research; communication

with the leadership in the provinces, both political and academic, to ensure that the environment and support for medical research runs broad and deep across the country; communication with all of the ministries; communication with Members of Parliament, whose constituents stand to gain from the outcomes of medical research; and finally regular and direct communication with all of the ministries relevant to research and its outcomes. This is a daunting task, but is core to the success of the enterprise. Unless all of CIHR's stakeholders understand and support its mission, funding will not grow and the outcomes of its many and diverse efforts will not be appreciated by the public or Canadian leadership.

Recommendation: Create a CIHR Office of Public and Government Affairs that serves "corporate" CIHR but is also staffed to help SDs with Institute-specific communication needs and/or issues. This Office would also lead communication efforts with various government agencies and Parliament.

Knowledge Translation

Canadian health research has seen an impressive development during the last ten years and is positioned very well among international competitors. The broadening of the mandate from biomedical research to health services and policy research and to population and public health aspects has been successfully taken up by CIHR.

The mandate of CIHR not only includes the generation of new knowledge in biomedicine, but also supporting the translation of this knowledge into practical applications that are of benefit for Canadians, i.e. as new diagnostic and therapeutic strategies. Although progress has been made in knowledge translation, a deeply entrenched culture for ensuring the translation of obtained knowledge does not yet exist. Industrial-academic interactions are not common and new instruments for bridging "translational gaps" need to be developed.

One of the biggest risk factors for innovative health research is the lack of highly qualified clinical scientists, which are well trained in basic and clinical science. CIHR has already recognized this gap; however, the instruments available to tackle this problem might not be sufficient.

CIHR devotes approximately 70% of its resources to open grant competitions and 30% to strategic initiatives. This is a good balance and it is important to maintain the pipeline of investigator-initiated grants to fuel discovery and future knowledge generation. The strategic initiatives are essential to ensure the integration of the four pillars of CIHR through funding mechanisms that span several disciplines. These also offer the opportunity for SDs and their IABs to implement their vision and move their field forward in directions that will benefit the health of Canadians.

The system has had some resounding success, but has also suffered some "growing pains." Fewer, bigger, and more coherent programs are now replacing a multiplicity of smaller programs. This is a welcome change that should be continued. Two points, however, continue to need attention. The success of these programs is contingent upon their sustainability. Hastily put

together teams to fit a call for proposal have little chance to have much impact if the investigators are not motivated by the prospect of renewal, and few programs can have transformative effects in just one funding cycle.

Another key to the long-term success of CIHR is the engagement of young investigators in strategic initiatives. This will require more than an artificial mandate to include young investigators in teams. They need to see benefits to their participation at a time when career development dictates the need to focus and develop an original, individual research agenda. Yet, it is essential to harness the great value they represent for Canadian health research and ultimately avoid brain drain.

A close dialogue between health researchers and the stakeholders of health research is essential. Individual Institutes within CIHR have made impressive progress in developing a community spirit and establishing bottom-up processes to discuss and implement new initiatives or to engage in public outreach. A professional and efficient communication strategy however is still missing.

The potential of modern communication tools through the internet for managing public relations or to serve as knowledge portals for all stakeholders is not used sufficiently. There seems to be some uncertainty about the responsibilities in this area, i.e. whether certain communication issues should be centralized or decentralized.

Recommendation: Create programs that are sustainable and can work over time to improve knowledge transfer between researchers, their institutions, CIHR and the public at all levels.

CIHR and Health Databases

Canada, Australia, some parts of the UK, and some Scandinavian countries have unique population data capacities with the ability to share data on diseases, their antecedents and outcomes, and aspects of care across the nation. In fact, the lack of these resources is one of the aspects of the U.S. health-care system that puts it at a disadvantage. In Canada, several Institutes and researchers have raised their considerable frustration with the lack of appreciation by federal agencies and those with the power to enhance capacity for data sharing. This could be a major resource for Canadian research. This is mostly for pillars 2, 3 and 4 which, for many Institutes, are the weakest areas of their activities. Some provinces such as Manitoba and Quebec have shown the feasibility of such linked data sets using provincial data and demonstrated how powerful they can be for epidemiological, clinical and health services research. If Canada expects to take real advantage of this unique capacity, then this is an urgent issue on which CIHR needs to respond and provide leadership.

A great example of this is the potential for pharmacoepidemiology and pharmacovigilance by enabling prescription data to be linked to all morbidity and mortality outcomes. The rules for such activities would need to be developed, of course. This would allow a more rapid detection of adverse events not picked up by randomized clinical trials, analysis of prescribing patterns, and whether drugs are being prescribed appropriately. Given that 70% of all drugs prescribed for children[10] and pregnant women have no RCT evidence of effectiveness or harm[11], and most RCTs

expressly exclude certain groups (e.g. co-morbidities, old people, Aboriginal people, women and children as mentioned, smokers, etc.), there is an urgent need to have the capacity to conduct such observational studies with these populations. Such capacity enables testing of new drugs in the "real world". To have data which can be used to prevent harm and improve services and not to make it available is morally culpable. Canada is now setting up such a capacity and it, therefore, could be an excellent "proof of principle" and demonstrate why such capacity is so important.

CIHR recently held a national meeting on data harmonization and linkage. Professor Paul Burton said at the meeting that the construction and management of a harmonized network of large biobanks that can realistically support the pooling of extensive data and samples is an absolute necessity at a global level if bioscience is to deliver on its promises to answer many of the scientific questions that are considered to be most important, e.g. questions about the joint effects of genes and environments in disease development, progression and treatment.

Recommendation: CIHR should lead a Canada-wide effort to harmonize data sets and enable national linkages which would benefit all CIHR Institutes and the Canadian research enterprise at large.

CIHR should ramp up its leadership role and activities to enable the use of the significant existing (and future planned) data bases for research, monitoring, evaluation and to enable Canada to both serve its own scientific community and to participate in big science projects globally. This should be done in collaboration with other national agencies and groups (e.g. Genome Canada, NSERC, SSHRC, Statistics Canada, Canada's Advanced Research Innovation Network: CANARIE, National Disease Consortia, Federal Health and Public Health and Health Charities and NGOs, etc.), provincial agencies that have specific expertise and long track records in linking and analyzing large data sets (e.g. Manitoba Centre for Health Policy), and bringing in international expertise as well.

CIHR's Drug Safety and Effectiveness Network (DSEN), is an important first step in this effort. DSEN provides information on the safety and effectiveness of pharmaceuticals when used by diverse patient populations outside the controlled experimental environment of clinical trials. It is supported by $36M over five years from the Government of Canada. DSEN is working to establish a Canada-wide collaborating centre to access relevant administrative data. Given the recognition of drug safety and effectiveness as an essential element of protecting the health of the public, it is anticipated that access to administrative data for this purpose will be viewed more favourably by provincial governments than if it were intended only for investigator-driven research.

Several ongoing initiatives and factors put Canada in a potential international leadership position in this regard: 1) the existence in Canada of complete population data on disease from both provincial agencies and registers; 2) several large longitudinal studies (many underpowered to address some of the most pressing scientific questions); 3) increasing biobanks of both specific diseases and population groups; 4) other valuable historical and contemporary information important to health outcomes (exposures, interventions, societal risk and protective factors, for example); and 5) outstanding expertise in data management, analysis and interpretation. Work is needed urgently to identify the impediments to national harmonization and linkage, access, privacy and ethical issues and the capacity to capitalize on these resources. CIHR is seen by all those we interviewed as the pivotal agency to lead this important activity.

Clinical and Translational Research

Clinical research is one of the four themes of CIHR research and accounts for approximately 20% of total CIHR research expenditures. In this report, in order to evaluate the current status of clinical research, it is helpful to define the term clinical research. Clinical research is defined as "patient-oriented" research that covers a broad range of activities that range from large scale randomized clinical trials, to proof of concept studies in humans, to experimental medicine, and to detailed studies of human physiology. Increasingly, translational research is included in this category. Human translational research can range from advancing discoveries to early proof of concept in humans, to developing evidence through RCTs, to moving evidence-based medicine into community practice through delivery, dissemination and diffusion of research, to evaluating the community outcomes of a scientific discovery in practice. As such, translational research overlaps with themes 3 and 4 (health systems and services research, and social, cultural, environmental and population health). In a broader context, since human application of a scientific discovery (knowledge translation) often involves the development of a product that can be disseminated, commercialization should also be included in the evaluation of translation.

The IRP was not provided detailed materials that permitted an in-depth evaluation of clinical and translational research. However, it is our impression that Canada has a strong track record in clinical research with historical evidence that Canadian-led landmark trials have had important impact on clinical practice. For example, the McMaster University group spearheaded the HOPE trial that has led to the routine use of ACE inhibitors for treating high-risk cardiovascular patients. However, it was pointed out by some informants that RCTs are underfunded by CIHR. It was also stated: "In Canada, we are good in doing research, but poor in translating it." These sentiments were shared by many who were interviewed.

Since methodologies and infrastructures for clinical and translational research are common across disciplines and Institutes, it was surprising to the IRP that there was little evidence for centralized CIHR cores supporting all Institutes in clinical trial design, data management and analysis, statistics and computation, bio and health informatics, etc. Also, there does not appear to be systemic support for the development of experimental medicine or "proof of concept in human" units, sometimes called "clinical research facilities" that facilitate in-depth clinical investigation that includes human genotyping-phenotyping, molecular imaging, statistics, systems biology, etc. Similarly, the systematic collection of patient materials and biobanking, as well as clinical and research databases, are critical elements for clinical and translational research, and CIHR should play a major role in these large infrastructures.

The success of clinical and translational research is important to advancing health and ultimately to improving health outcomes. Thus, it is essential that CIHR invest sufficiently in clinical and translational research. The relative spending on clinical and translational research versus the other three themes is an important strategic decision for CIHR. CIHR must invest in cores and infrastructure that transversely facilitate and assist all Institutes and researchers in developing high-quality science that increases our understanding of human physiology, pathways and mechanisms of health and diseases; and in innovative research that proves clinical hypotheses and provides clinical evidence through RCTs.

The IRP was made aware of the proposed CIHR Strategy for Patient-Oriented Research that aims to address the translational research gap.[12] The strategy will facilitate cooperation between public and private partners, develop infrastructure, train future clinical researchers, fund patient-oriented research and promote research uptake into clinical practice. This initiative represents an important opportunity for CIHR and Canada.

In summary, although Canadian clinical research is relatively strong, translational research is underdeveloped. Now is the opportunity to develop a national strategy to strengthen these areas through the establishment of networks and infrastructure, focusing on clinical studies that have high impact on Canadian health, particularly Aboriginal health, and collaboration across the research themes.

> ***Recommendation: Establish Canadian Centres of Excellence of Clinical and Translational Research, which will develop the critical mass of scientists coupled with research infrastructure (horizontal integration) to expedite the advancement of basic discoveries to human application, impact clinical practice, and community health. Implement the Strategy for Patient-Oriented Research.***

These centres could also function as collaborative networks and become sites of training of future clinical and translational researchers to ensure capacity building. Discussion should be opened with CFI to advance this concept.

It will also be important to weigh investment in particular trials based on the relevance to the Canadian population and society. Of particular significance is to conduct trials that are meaningful to the health of the Aboriginal population. Accordingly, it is important to mandate enrollment of Aboriginals in all Canadian clinical trials with sufficient power to draw appropriate conclusions and also to conduct RCTs specifically focused on Aboriginal health. Finally, CIHR must develop operating mechanisms to closely monitor the recruitment of subjects and the conduct of RCTs in a time- and cost-efficient manner.

Translational research is often divided into two tiers, T1 and T2. T1 research refers to first-in-man studies where a new concept developed in the test tube and animal models is first tested in humans. T2 research refers to knowledge transfer into the delivery of care and, where appropriate, commercialization. In Canada, both T1 and T2 research need further development, particularly the latter. There is a need for improved licensing and technology transfer, a national intellectual property policy and strategy, and the commercialization of novel discoveries and products.

> ***Recommendation: Provide sufficient funding for RCTs to ensure adequate sample size and statistical power. In view of current budget constraints, it will be important for CIHR to prioritize and only select trials with high potential impact. One effective approach to reduce cost is to develop international partnerships and collaborations.***

New Knowledge and Strategic Gaps

One of the key elements of CIHR's mandate is the creation of new knowledge and its subsequent translation into improved health for Canadians. Since the last review, CIHR has made great

strides to fulfill the enormous breadth of this mandate. CIHR is very well on its way to develop an integrated health research agenda that includes not only bio-medical and clinical research, but also research concerning health systems, health services and the health of populations.

In order to maintain long-term excellence in Canadian health research, the continuous development of new knowledge is essential. Without new knowledge there is nothing to translate. The process of how, within CIHR's mandate, new areas with a potential to generate new knowledge with particular relevance for the health of Canadians can be identified is not entirely clear.

Whereas individual SDs are taking on leadership for new topics that emerge within their own disciplines, this seems to be more difficult for areas that need input from more distant disciplines, such as engineering, materials sciences or social sciences. For example, there was an absence of convincing strategy for how the Canadian health research community will deal with the overwhelming amount of scientific and medical data that will become available in the near future. Technologies such as next-generation sequencing, non-invasive imaging or the development of new genome-wide proteome or metabolome analysis technologies will produce information in an unprecedented manner.

Arising challenges in data storage, high-performance computing or data visualization are apparently not yet on the agenda of CIHR's research strategy. This is also the case for exploring the potential of e-health and dealing appropriately with its technical, social and economic complexities. Emerging opportunities, driven by advances in information and communication technologies, have not yet found their way into interdisciplinary joint initiatives.

There seems to be very little interaction between CIHR-driven health research and leading academic and industrial experts in mathematics, physics, computer science or the various engineering disciplines. Bioengineering has moved very high on the agenda of most engineering schools worldwide, and the interface with health research is one of the most promising application domains of this field. Although CIHR has implemented new tools to identify relevant initiatives, it might be necessary to critically reflect on whether the process in place works sufficiently and is suitable to capture innovations on the basis of interdisciplinary cooperation. The Review Panel missed a convincing process and roadmap of how progress in fields such as bioengineering, materials sciences or bioinformatics can and will be integrated with activities in health research to contribute to new diagnostic or therapeutic strategies and public health.

New knowledge often arises at interfaces between different disciplines. It is, therefore, particularly important that processes be put in place that systematically explore the potential of new interdisciplinary cooperation within and between institutions. CIHR and the different councils and agencies (i.e. NSERC, SSHRC, CFI and Genome Canada) have started to work closer together. However, the balance between competition and cooperation of these organizations is still not optimal and there seems to exist a major potential not used yet efficiently.

An important question relates to the balance between investments that ensure the long-term creation of new knowledge and the development of an environment ensuring the translation of this knowledge into benefits for the country. As can be seen from the increase in the absolute and relative numbers of biomedical papers published compared to other countries, Canada greatly

strengthened its position in basic and clinical research in the last decade. Success in the translation of this knowledge into practical application has not yet been achieved at the same degree.

Health research is rapidly evolving and profits enormously from advances in other scientific disciplines. This is particularly obvious for all aspects of information and communication technologies. Data generation has quickly outgrown the capacity and ability to store and analyze data. High throughput analyses and multi-parameter measurements of biological and clinical samples converge with a computationally driven analysis of complex biological systems and clinical and medical information.

Statistical physics, systems control, and network science provide a new foundation for future health research. Bioinformatics, medical informatics, computational and systems biology will need to become part of the overall strategy of health research. The Review Panel is concerned that these developments have not been appropriately considered and integrated in CIHR strategy. Bioinformatics and computational and systems biology are at the forefront of international health research, but have surprisingly not yet found their way into major CIHR initiatives and programs.

Individual academic research units are often not able to provide the necessary expertise and know-how or to maintain the fast and expensive cycles in information and communication technology. For this reason, it is necessary to develop a national roadmap in order to provide the appropriate infrastructure necessary for competitive health research, i.e. in high-performance computing or data storage. This often requires international cooperation that serves not only a few research units, but increasingly a larger number of research institutes, i.e. within a region, a country or even beyond.

This raises the question of the general adequacy of the process of identifying strategic gaps and implementing new initiatives that are particularly promising in terms of their potential for innovation and impact on the health-care system.

> ***Recommendation: CIHR should catalyze new areas of research that are beyond its current knowledge domains, including the domains of mathematics, physics, computer and materials sciences, bioinformatics and certain engineering disciplines such as bioengineering. Strategic cooperation with other partners, e.g. Genome Canada or NSERC, should be considered in order to facilitate the development of a national bioinformatics strategy. Other areas such as human ecology, operations research or the study of complexity in general might be worth exploring.***

Human Capital

There is an overriding concern about the continuity of support for career development, but there is scant data to understand the long-term outcomes of young investigators. The reasons for concern are many. New investigators get 3-5 years of funding, but there is no follow-on program. What is needed is data about success vs. attrition of scientists in the context of national and CIHR goals for science. As noted by more than one SD, the conversation about goals must be held together with universities.

We heard from new investigators that some get no teaching relief, or that they alienate departments by creating a vacuum in teaching without providing money for the department to replace them. Clearly, it is very uneven without policies that have traction in the system. Moreover, because of the unusually substantial disconnect between capital budgets and operating (CIHR) funding, universities have created space to recruit outstanding scientists, but these individuals stretch the capacity of CIHR to support their research. This is not a unique problem to Canadian science, but given the fragmentation of decision-making and funding sources there is a particular risk for career trajectories.

There is a particular concern about the support for clinician-scientists, many of whom have 50% time or less for research. Canada is not alone in facing attrition of clinician-scientists, but as for the broader picture of career support, clear goals and data would be important. It is hard to imagine clinician-scientists with 50% or more time in the clinic making seminal contributions to science – of course, there will always be rare exceptions – or staying on top of rapidly changing fields.

Recommendation: CIHR should work with the nation's universities to enhance the career paths of its young investigators. Particular attention should be paid to clinical investigators who must balance clinical service obligations with research.

Organizational Aspects

With its large mandate and limited resources, a key challenge for the President of CIHR has been to develop the foundation of an effective organization. The IRP was impressed with the systematic approach and rationalization of the governance, advisory and administrative structure of CIHR over the past few years. The organization of strategic planning, such as CIHR Roadmap, the proactive approach to problems such as the needed improvement in the peer review system are strong indications that the President has been able to develop an effective team.

Recommendation: CIHR's President should create a position of Deputy Director for Operations and Management. Given the need to now look more externally to better engage other agencies of government at federal and provincial levels, to represent CIHR to its many stakeholders, to create new national and international partnerships, and to raise the profile and influence of CIHR nationally, this position would free the President to give more attention to these needs, especially since he has stabilized the organization and established good internal processes.

Conclusions

The IRP is pleased with the significant progress made by CIHR since the last review. Clearly, the organization led by a dynamic and committed President, outstanding SDs, and a dedicated staff exudes a positive attitude despite a broad mandate that is, in our opinion, quite successful, especially for the amount of resources given to CIHR.

Many IRP members noted that no other organization for health research in the world has such a broad mandate. Despite this challenge, CIHR is fulfilling its missions to a surprisingly high degree. Governance and strategic planning have markedly improved. The coordination between Institutes and the balance between targeted and investigator-initiated research seems to be appropriate and refocused on a smaller number of initiatives.

More importantly, the IRP found that the leadership of CIHR was quite aware of the reality on the ground for its grantees. CIHR recognizes the areas where it needs improvements such as peer review mechanisms, which are currently undergoing a review, coordination with other agencies, which has also improved since the last review, with CIHR engaging regularly with other funding agencies. However, because of a lack of developed metrics and evaluation parameters, it was difficult for IRP members and review panels for each Institute to fully assess the effectiveness of the programs, but this is to be expected in a less than 10-years old agency. This area will require more attention in the future and should not only facilitate reviews but provide CIHR and its policy makers with the tools to optimally guide the agency.

The IRP finds a lack of clarity in terms of translation of research into commercial opportunities and partnerships. This may not be a core mandate of CIHR, but needs to be clarified in terms of policy on intellectual property and technology transfer so as to facilitate such transfers through its grantees and their institutions. The IRP recognizes that such policy setting may not be in the sole purview of CIHR and may need to be addressed at higher levels.

The IRP found again that the task of CIHR is made more difficult by the structure of funding streams for health research. The Canadian system with its multiple federal and provincial sources of funding is quite complex and may hamper the efficiency of research. Obviously, this is beyond the purview of CIHR, but it may benefit to be reviewed to reduce its fragmentation and increase the synchronization and coordination of all sources of support to enable efficient performance of research in Canada.

Lastly, the President should be commended for his organizational leadership in the past few years, which have been challenging due to resource constraints and the growing pains of a young institution. The IRP feels that CIHR would now enhance its mission and benefits by allowing the President to focus increasingly on the external aspects and total ecosystem in which CIHR needs to operate, from provinces to federal government to international arenas, to maximize its leverage. Consideration to the appointment of a Deputy Director focused on internal operations and management may be appropriate at this time.

Appendix 1

International Review Panel Members

Chair – Dr. Elias Zerhouni
President, Global Research & Development (Medicines and Vaccines), sanofi-aventis
Senior Advisor, Johns Hopkins Medicine
Former Director, US National Institutes of Health

Professor Rudi Balling Director Luxembourg Centre for Systems Biomedicine University of Luxembourg	Professor Sir John Bell Regius Professor of Medicine Oxford University President, Academy of Medical Sciences United Kingdom
Professor Christian Bréchot Vice-President, Medical and Scientific Affairs Institut Mérieux France	Dr. Marie-Françoise Chesselet Charles H. Markham Professor of Neurology Chair, Department of Neurobiology David Geffen School of Medicine University of California at Los Angeles United States
Dame Sally Davies Chief Medical Officer and Chief Scientific Adviser Department of Health, National Health Service United Kingdom	Professor Victor Dzau Chancellor, Health Affairs, Duke University President and CEO, Duke University Health System James B. Duke Professor of Medicine Durham NC United States
Dr. Steven E. Hyman Provost, Harvard University Professor of Neurobiology, Harvard Medical School Boston MA United States	Dr. Jan Lundberg Executive Vice-President, Science and Technology President, Lilly Research Laboratories Indianapolis IN United States
Dr. Christopher J.L. Murray Director, Institute for Health Metrics and Evaluation Professor of Global Health, University of Washington Seattle WA United States	Professor Fiona Stanley Director, Telethon Institute for Child Health Research Chair, Australian Research Alliance for Children and Youth Professor, School of Paediatrics and Child Health University of Western Australia Perth, Australia

Appendix 2

Key Informants – March IRP Meeting

Senior Government Officials

Mr. Simon Kennedy Senior Associate Deputy Minister Industry Canada	Ms. Glenda Yeates Deputy Minister Health Canada
Dr. David Butler-Jones Chief Public Health Officer Public Health Agency of Canada	Mr. Louis Lévesque Deputy Minister of International Trade Foreign Affairs and International Trade Canada
Mr. Ian Shugart Deputy Minister Human Resources and Skills Development Canada	Dr. Howard Alper Chair Science, Technology and Innovation Council Industry Canada

Research Leaders' Forum

Dr. Mickie Bhatia McMaster University	Professor Tim Caulfield University of Alberta
Dr. Aled Edwards University of Toronto	Dr. Robert Hancock University of British Columbia
Dr. Sergio Grinstein University of Toronto	Dr. Thomas Hudson Ontario Institute for Cancer Research
Dr. Prabhat Jha University of Toronto	Dr. Kue Young University of Toronto
Dr. Bartha Knoppers McGill University	Dr. Salim Yusuf McMaster University
Dr. Shoo Lee University of British Columbia	Dr. Tak Mak University of Toronto
Dr. David Henry Institute of Clinical Evaluative Sciences	

Consultation with New Investigators

Dr. Frédéric Charron Institut de recherches cliniques de Montréal	Dr. Anne-Claude Gingras Samuel Lunenfeld Research Institute Mount Sinai Hospital
Dr. Russell Jones McGill University	Dr. Marc-André Langlois University of Ottawa
Dr. Jonathon Maguire University of Toronto	Dr. Guillaume Paré McMaster University
Dr. Debbie Martin Dalhousie University	

Stakeholders' Discussion

Mr. Peter Brenders President and CEO BIOTECanada	Ms. Sally Brown CEO (2001-2010) Heart and Stroke Foundation
Dr. Paul Hébert Editor-in-chief *Canadian Medical Association Journal* (CMAJ)	Mr. Martin LeBlanc President and CEO Caprion Proteomics
Mr. Paul Lévesque CEO Pfizer Inc.	Mr. Mark Lievonen President Sanofi-Pasteur Limited
Dr. Jacques Magnan Co-chair, NAPHRO (National Association of Provincial Health Research Organizations) Alberta Heritage Foundation for Medical Research	Dr. Heather Munroe-Blum President and Vice-Chancellor McGill University
Mr. Allan Rock President University of Ottawa	Mr. Yves Savoie President Multiple Sclerosis Society
Mr. Russell Williams President Canada Research Based Pharmaceutical Companies (Rx&D)	

Federal Research Agencies Forum

Dr. Suzanne Fortier President Natural Sciences and Engineering Research Council of Canada (NSERC)	Dr. Chad Gaffield President Social Sciences and Humanities Research Council of Canada (SSHRC)
Mr. John McDougall President National Research Council of Canada (NRC)	Dr. Pierre Meulien President and CEO Genome Canada
Ms. Maureen O'Neil President and CEO Canadian Health Services Research Foundation (CHSRF)	Dr. Gilles Patry President Canada Foundation for Innovation (CFI)
Mr. Michael Clarke Director Information and Communication Technologies for Development International Development Research Centre (IDRC)	

CIHR Team

Dr. Alain Beaudet, MD, PhD President	Mrs. Christine Fitzgerald Executive Vice-President
Dr. Pierre Chartrand, PhD Chief Scientific Officer Vice-President, Research	Dr. Ian Graham, PhD Vice-President Knowledge Translation and Public Outreach
Mr. James Roberge Chief Financial Officer and Vice-President, Resource Planning and Management	Dr. Kelly VanKoughnet Associate Vice-President Research
Mr. Geoffrey Hynes, MSc Manager, International Review	

CIHR Scientific Directors

Dr. Anne Martin-Matthews CIHR Institute of Aging (CIHR-IA) University of British Columbia	Dr. Malcolm King CIHR Institute of Aboriginal Peoples' Health (CIHR-IAPH) University of Alberta
Dr. Morag Park CIHR Institute of Cancer Research (CIHR-ICR) McGill University	Dr. Jean Rouleau CIHR Institute of Circulatory and Respiratory Health (CIHR-ICRH) University of Montreal
Dr. Paul Lasko CIHR Institute of Genetics (CIHR-IG) McGill University	Dr. Joy Johnson CIHR Institute of Gender and Health (CIHR-IGH) University of British Columbia
Dr. Michael Kramer CIHR Institute of Human Development, Child and Youth Health (CIHR-IHDCYH) McGill University	Dr. Robyn Tamblyn CIHR Institute of Health Services and Policy Research (CIHR-IHSPR) McGill University
Dr. Marc Ouellette CIHR Institute of Infection and Immunity (CIHR-III) Laval University	Dr. Jane Aubin CIHR Institute of Musculoskeletal Health and Arthritis (CIHR-IMHA) University of Toronto
Dr. Philip Sherman CIHR Institute of Nutrition, Metabolism and Diabetes (CIHR-INMD) University of Toronto	Dr. Anthony Phillips CIHR Institute of Neurosciences, Mental Health and Addiction (CIHR-INMHA) University of British Columbia
Dr. Nancy Edwards CIHR Institute of Population and Public Health (CIHR-IPPH) University of Ottawa	

Appendix 3

Expert Review Team Members

CIHR Institute of Aging (CIHR-IA)

Chair – Professor Carol Brayne Professor of Public Health Medicine Department of Public Health and Primary Care University of Cambridge United Kingdom	Expert Reviewer – Professor Kyriakos S. Markides Annie and John Gnitzinger Distinguished Professor of Aging Director, Division of Sociomedical Sciences Department of Preventive Medicine and Community Health Editor, *Journal of Aging and Health* University of Texas Medical Branch in Galveston, United States
International Review Panel – Professor Fiona Stanley	

CIHR Institute of Aboriginal Peoples' Health (CIHR-IAPH)

Chair – Jeffrey A. Henderson, MD, MPH President and CEO Black Hills Center for American Indian Health, South Dakota United States	Expert Reviewer – Professor Linda Tuhiwai Smith Professor of Education and Maori Development Pro Vice-Chancellor Maori Dean, School of Maori and Pacific Development University of Waikato, New Zealand
International Review Panel – Professor Fiona Stanley	

CIHR Institute of Cancer Research (CIHR-ICR)

Chair – Dr. Victor Ling Scientific Director, Terry Fox Research Institute Distinguished Scientist, BC Cancer Agency Professor, Departments of Biochemistry and Molecular Biology, and Pathology and Laboratory Medicine University of British Columbia	Expert Reviewer – Dr. Margaret Tempero Deputy Director and Director of Research Programs, UCSF Helen Diller Family Comprehensive Cancer Center, Department of Medicine University of California at San Francisco United States
International Review Panel – Professor Rudi Balling	

CIHR Institute of Circulatory and Respiratory Health (CIHR-ICRH)

Chair – Professor Stephen Holgate MRC Clinical Professor of Immunopharmacology School of Medicine University of Southampton United Kingdom	Expert Reviewer – Dr. Duncan Stewart CEO, Scientific Director and Vice-President, Research The Ottawa Hospital The Evelyn and Rowell Laishley Chair Professor, Department of Medicine University of Ottawa
International Review Panel – Professor Victor Dzau	

CIHR Institute of Genetics (CIHR-IG)

Chair – Professor Han G. Brunner Professor of Medical Genetics Head – Department of Human Genetics Radboud University Nijmegen Medical Centre The Netherlands	Expert Reviewer – Professor Jim R. Lupski The Cullen Endowed Chair in Molecular Genetics Professor, Department of Molecular and Human Genetics and Department of Pediatrics Baylor College of Medicine Houston United States
International Review Panel – Professor Rudi Balling	

CIHR Institute of Gender and Health (CIHR-IGH)

Chair – Professor Hilary Graham Professor of Health Sciences University of York Director, Public Health Research Consortium United Kingdom	Expert Reviewer – Dr. Marianne Legato Professor of Clinical Medicine Columbia University College of Physicians and Surgeons Adjunct Professor of Medicine Johns Hopkins University United States
International Review Panel – Dr. Marie-Françoise Chesselet	

CIHR Institute of Human Development, Child and Youth Health (CIHR-IHDCYH)

Chair – Dr. Richard B. Johnston Associate Executive Vice-President Academic Affairs, National Jewish Health Associate Dean, Research Development School of Medicine, University of Colorado United States	Expert Reviewer – Dr. Roberto Romero Chief, Perinatology Research Branch Program Director, Obstetrics and Perinatology Division of Intramural Research, NICHD/NIH Professor of Molecular Obstetrics and Genetics, Wayne State University Detroit, MI United States
International Review Panel – Professor Fiona Stanley	

CIHR Institute of Health Services and Policy Research (CIHR-IHSPR)

Chair – Professor Sally Redman CEO, Sax Institute Sydney, NSW Australia	Expert Reviewer – Professor Sally Macintyre Professor, Division of Community Based Sciences, Faculty of Medicine University of Glasgow Honorary Director, MRC/CSO Social and Public Health Sciences Unit United Kingdom
International Review Panel – Dr. Chris Murray	

CIHR Institute of Infection and Immunity (CIHR-III)

Chair – Professor Deborah Smith Professor of Molecular Parasitology Centre for Immunology and Infection University of York Chair, MRC Infections and Immunity Research Board United Kingdom	Expert Reviewer – Professor Hidde Ploegh Professor, Department of Biology Whitehead Institute for Biomedical Research Massachusetts Institute of Technology Cambridge, MA United States
International Review Panel – Professor Rudi Balling	

CIHR Institute of Musculoskeletal Health and Arthritis (CIHR-IMHA)

Chair – Professor Alan J. Silman Medical Director Arthritis Research United Kingdom	Expert Reviewer – Dr. Matthew H. Liang Professor of Medicine Harvard Medical School Professor of Health Policy and Management Harvard School of Public Health Boston, MA United States
International Review Panel – Professor Victor Dzau	

CIHR Institute of Nutrition, Metabolism and Diabetes (CIHR-INMD)

Chair – Dr. Garret A. FitzGerald Chair, Department of Pharmacology Director, Institute for Translational Medicine and Therapeutics University of Pennsylvania United States	Expert Reviewer – Professor W. Philip T. James President, International Association for the Study of Obesity Honorary Professor of Nutrition London School of Hygiene and Tropical Medicine United Kingdom
International Review Panel – Professor Christian Bréchot	

CIHR Institute of Neurosciences, Mental Health and Addiction (CIHR-INMHA)

Chair – Professor T.W. Robbins Professor of Cognitive Neuroscience Chair of Experimental Psychology University of Cambridge United Kingdom	Expert Reviewer – Professor Charles P. O'Brien Kenneth Appel Professor University of Pennsylvania Vice Director, Institute of Neurological Sciences Director, Center for Studies of Addiction University of Pennsylvania United States
International Review Panel – Dr. Marie-Françoise Chesselet	

CIHR Institute of Population and Public Health (CIHR-IPPH)

Chair – Professor Sally Macintyre Professor, Division of Community Based Sciences, Faculty of Medicine University of Glasgow Honorary Director, MRC/CSO Social and Public Health Sciences Unit United Kingdom	Expert Reviewer – Professor Don Nutbeam Vice-Chancellor, University of Southampton Professor of Public Health United Kingdom
International Review Panel – Dr. Chris Murray	

Appendix 4

Key Informants by Session – Institute Reviews February 2011

Session 1 – Review of the Institute – This session focused on how the Institute has delivered on its mandate and contributed to achieving CIHR's mandate. There was discussion on the core functions, leadership, achievements and opportunities for the Institute.

Name	Affiliation	Institute
Dr. Colleen Flood	Institute Scientific Director (former)	IHSPR
Dr. Robyn Tamblyn	Institute Scientific Director (current)	IHSPR
Dr. Jean-Louis Denis	IAB Chair, Professor, Department of Health Administration, University of Montreal	IHSPR
Dr. Anne Sales	Associate Professor, Faculty of Nursing, University of Alberta	IHSPR
Dr. Anne Martin-Matthews	Institute Scientific Director	IA
Dr. Rebecca Jane Rylett	IAB Chair, Professor of Physiology, Pharmacology and Toxicology, University of Western Ontario	IA
Dr. Dorothy Pringle	Professor, Faculty of Nursing, University of Toronto	IA
Dr. Christopher Patterson	Professor and Chief of Geriatric Medicine, Health Sciences Centre, McMaster University	IA
Dr. Marc Ouellette	Institute Scientific Director	III
Dr. Chris Power	IAB Chair, Professor, Department of Medical Microbiology and Immunology, Faculty of Medicine and Dentistry, University of Alberta	III
Dr. Katherine Siminovitch	Head, Division of Genomic Medicine, Toronto General Research Institute	III
Dr. Martin Schechter	Professor, School of Population and Public Health, University of British Columbia	III
Dr. Anthony Phillips	Institute Scientific Director	INMHA
Dr. Ravi Menon	IAB Chair, Professor, Biomedical Engineering and Psychiatry, University of Western Ontario	INMHA
Dr. Roberta Palmour	Professor, Department of Psychiatry, McGill University	INMHA
Dr. Samuel Weiss	Professor, Departments of Cell Biology and Anatomy, and Pharmacology and Therapeutics, University of Calgary	INMHA
Dr. Jean Rouleau	Institute Scientific Director	ICRH
Dr. Yves Berthiaume	IAB Chair, Professor, Faculty of Medicine, University of Montreal	ICRH
Dr. Pavel Hamet	Director of Research, Centre Hospitalier, University of Montreal	ICRH

Name	Affiliation	Institute
Dr. Rob Beanlands	Professor, Divisions of Cardiology and Radiology, Department of Medicine, University of Ottawa	ICRH
Dr. Nancy Edwards	Institute Scientific Director	IPPH
Dr. Gilles Paradis	IAB Chair (2007-09), Professor, Department of Epidemiology, Biostatistics and Occupational Health, McGill University	IPPH
Dr. Roy Cameron	Professor, Faculty of Applied Health Sciences, University of Waterloo	IPPH
Dr. Clyde Hertzman	Professor, School of Population and Public Health, University of British Columbia	IPPH
Dr. Michael Kramer	Institute Scientific Director	IHDCYH
Dr. Jean-Marie Moutquin	IAB Chair, Professor and Chair, Department of Obstetrics and Gynaecology, University of Sherbrooke	IHDCYH
Dr. Victor Han	Professor, Departments of Paediatrics, Obstetrics and Gynaecology, Biochemistry and Anatomy, and Cell Biology, University of Western Ontario	IHDCYH
Dr. K.S. Joseph	Professor, Department of Obstetrics and Gynaecology, University of British Columbia	IHDCYH
Dr. Morag Park	Institute Scientific Director	ICR
Dr. William Mackillop	IAB Chair, Professor and Chair, Department of Community Health and Epidemiology, Queen's University	ICR
Dr. Heather Bryant	Clinical Professor, Department of Community Health Sciences and Oncology, University of Calgary	ICR
Dr. Gerry Johnston	Professor, Department of Microbiology and Immunology, Dalhousie University	ICR
Dr. Joy Johnson	Institute Scientific Director	IGH
Dr. Blye Frank	IAB Chair, Professor and Head, Department of Bioethics, Dalhousie University	IGH
Dr. Joan Bottorff	Professor, School of Nursing, Faculty of Health and Social Development, University of British Columbia	IGH
Dr. Gillian Einstein	Director and Founder, Collaborative Graduate Program in Women's Health, University of Toronto	IGH
Dr. Jane Aubin	Institute Scientific Director	IMHA
Dr. Phillip Gardiner	IAB Chair, Professor, Faculty of Medicine, Department of Physiology, University of Manitoba	IMHA
Dr. Jeff Dixon	Professor, Department of Physiology and Pharmacology, University of Western Ontario	IMHA
Dr. Monique Gignac	Associate Professor, Faculty of Medicine, University of Toronto	IMHA
Dr. Philip Sherman	Institute Scientific Director	INMD

Name	Affiliation	Institute
Dr. Stephanie Atkinson	IAB Chair, Professor and Associate Chair (Research), Department of Pediatrics, McMaster University	INMD
Dr. Denis Richard	Director, Centre for Research on Energy Metabolism, Laval University	INMD
Dr. Stephen Collins	Professor, Department of Medicine, McMaster University	INMD
Dr. Malcolm King	Institute Scientific Director	IAPH
Dr. Margo Greenwood	IAB Chair, Departments of Education and First Nations Studies, University of Northern British Columbia	IAPH
Dr. Judy Bartlett	Professor and Health Director, Department of Community Health Sciences, University of Manitoba	IAPH
Dr. Frederic Wien	Member, Make Poverty History Expert Advisory Committee, Assembly of First Nations	IAPH
Dr. Paul Lasko	Institute Scientific Director	IG
Dr. Michel Bouvier	IAB Chair, Professor, Biochemistry, Institute for Research on Immunology and Cancer, University of Montreal	IG
Dr. François Rousseau	Professor, Department of Medical Biology, Laval University	IG

Session 2 – Consultation with Researchers – This session addressed the perspectives of various researchers within their field of research and focused on the effectiveness of CIHR and the Institute in supporting this field of research in Canada.

Name	Affiliation	Institute
Dr. Pat Martens	Professor, Faculty of Medicine, University of Manitoba	IHSPR
Dr. Paula Goering	Professor, Department of Psychiatry, University of Toronto	IHSPR
Dr. Bill Hogg	Professor and Director of Research, Department of Family Medicine, University of Ottawa	IHSPR
Dr. Karim Khan	Professor and Clinician-Scientist, Department of Family Practice, University of British Colombia	IA
Dr. Kenneth Rockwood	Professor, Geriatric Medicine, Faculty of Medicine, Dalhousie University	IA
Dr. Parminder Raina	Professor, Department of Clinical Epidemiology and Biostatistics, McMaster University	IA
Dr. Keith Fowke	Associate Professor, Department of Medical Microbiology, University of Manitoba	III
Dr. Sean B. Rourke	Assistant Professor, Department of Psychiatry, University of Toronto	III
Dr. Michel Bergeron	Director, Division of Microbiology and Centre de Recherche en Infectiologie, Laval University	III

Name	Affiliation	Institute
Dr. Adriana Di Polo	Associate Professor, Faculty of Medicine, Department of Pathology and Cell Biology, University of Montreal	INMHA
Dr. Glenda MacQueen	Professor and Head, Department of Psychiatry, Faculty of Medicine, University of Calgary	INMHA
Dr. A. Jonathan Stoessl	Professor and Acting Division Head, Faculty of Medicine, Division of Neurology, University of British Columbia	INMHA
Dr. Art Slutsky	Professor, Department of Medicine, Biomedical Engineering and Surgery, University of Toronto	ICRH
Dr. Jean-Claude Tardif	Professor, Faculty of Medicine, University of Montreal	ICRH
Dr. Jack Tu	Professor, Faculty of Medicine, Department of Health Policy, Management and Evaluation, University of Toronto	ICRH
Dr. Louise Potvin	Professor, Social and Preventive Medicine, Faculty of Medicine, University of Montreal	IPPH
Dr. David Hammond	Assistant Professor, Department of Health Studies and Gerontology, University of Waterloo	IPPH
Dr. Patricia O'Campo	Professor, Division of Epidemiology, Social and Behavioral Health Sciences, University of Toronto	IPPH
Dr. Bruce Murphy	Professor, Faculty of Veterinary Medicine, University of Montreal	IHDCYH
Dr. Bernard Thébaud	Professor, Department of Physiology, University of Alberta	IHDCYH
Dr. Bonnie Stevens	Professor, Faculty of Nursing and Faculty of Medicine, University of Toronto	IHDCYH
Dr. Richard Doll	Adjunct Professor, Faculty of Health Sciences, Simon Fraser University	ICR
Dr. Fei-Fei Liu	Professor, Departments of Medical Biophysics, Radiation Oncology and Otolaryngology, Faculty of Medicine, University of Toronto	ICR
Dr. Danielle Julien	Professor, Department of Psychology, University of Quebec at Montreal	IGH
Dr. Harriet MacMillan	Professor, Psychiatry, Behavioural Neurosciences and Pediatrics, McMaster University	IGH
Dr. Karin Humphries	Associate Professor, Division of Cardiology, Department of Medicine, University of British Columbia	IGH
Dr. Hani El-Gabalawy	Professor and Chair (Research), Rheumatology, Faculty of Medicine, University of Manitoba	IMHA
Dr. Jan Dutz	Associate Professor, Division of Dermatology and Skin Science, Faculty of Medicine, University of British Columbia	IMHA
Dr. Gilles Lavigne	Professor, Faculty of Dentistry, University of Montreal	IMHA

Name	Affiliation	Institute
Dr. John Wallace	Professor, Division of Gastroenterology, Department of Medicine, McMaster University	INMD
Dr. Lise Gauvin	Professor, Department of Social and Preventive Medicine, University of Montreal	INMD
Dr. Kevin Burns	Professor, Division of Nephrology, University of Ottawa and Ottawa Hospital	INMD
Dr. Chantelle Richmond	Assistant Professor, Cross Appointed with First Nations Studies, Department of Geography, University of Western Ontario	IAPH
Dr. Rod McCormick	Assistant Professor, Department of Educational and Counseling Psychology, and Special Education, University of British Columbia	IAPH
Dr. Laura Arbour	Pediatrician, Department of Medical Genetics, University of British Columbia	IAPH
Dr. Howard Lipshitz	Professor and Chair, Department of Molecular Genetics, University of Toronto	IG
Dr. Christopher Yip	Professor, Department of Biochemistry and Department of Chemical Engineering and Applied Chemistry, University of Toronto	IG
Dr. Kym Boycott	Medical Geneticist, Regional Genetics Program, Investigator, Children's Hospital of Eastern Ontario	IG

Session 3 – Roundtable with Stakeholders – This session focused on Institute progress, partnership ability, strengths, weaknesses, achievements and opportunities.

Name	Affiliation	Institute
Ms. Pauline Rousseau	Executive Director, Strategic Planning Branch, Saskatchewan Health	IHSPR
Ms. Lillian Bayne	President, Lillian Bayne & Associates, Former Assistant Deputy Minister of Health	IHSPR
Ms. Alison Paprica	Acting Director, Health System Planning and Research Branch, Ontario Ministry of Health and Long-Term Care	IHSPR
Mr. Dave Clements	Director, Corporate Planning and Accountability, Canadian Institute for Health Information	IHSPR
Dr. Ruth Wilson	Professor, Department of Family Medicine, Queen's University	IHSPR
Dr. Janice Keefe	Professor, Department of Family Studies and Gerontology, Mount Saint Vincent University	IA
Ms. Debbie Benczkowski	Chief Operating Officer, Alzheimer Society of Canada	IA

Name	Affiliation	Institute
Ms. Louise A. Plouffe	Manager, Knowledge Development, Division of Aging and Seniors, Public Health Agency of Canada	IA
Dr. Michael Wolfson	Canada Research Chair in Population Health Modelling/Populomics, University of Ottawa	IA
Dr. Mike Mulvey	Chief, Antimicrobial Resistance and Nosocomial Infections, National Microbiology Laboratory, Public Health Agency of Canada	III
Dr. Chris Archibald	Director, Surveillance and Risk Assessment Division, Public Health Agency of Canada	III
Dr. Arlene King	Chief Medical Officer of Health, Ontario Ministry of Health and Long-Term Care	III
Dr. Neil Cashman	Scientific Director, PrioNet Canada	III
Dr. Alain Gendron	Medical Advisor, AstraZeneca Inc.	INMHA
Mr. Philip Upshall	National Executive Director, Mood Disorders Society of Canada	INMHA
Dr. Jane Hood	Director, Research and Knowledge Development, British Columbia Mental Health and Addictions Research Network	INMHA
Dr. Denise Figlewicz	Vice-President of Research, ALS Society of Canada	INMHA
Ms. Linda Piazza	Director of Research, Heart and Stroke Foundation of Canada, Ottawa	ICRH
Ms. Marla Israel	Centre for Chronic Disease Prevention and Control, Public Health Agency of Canada	ICRH
Ms. Michele McEvoy	Research and Knowledge Translation, The Lung Association, Ottawa	ICRH
Dr. Norman Campbell	Professor, Faculty of Medicine, University of Calgary	ICRH
Dr. Cory Neudorf	Chief Medical Health Officer, Saskatoon Health Region, Chair, Canadian Public Health Association	IPPH
Dr. Michael Wolfson	Canada Research Chair in Population Health Modelling/Populomics, University of Ottawa	IPPH
Dr. Gregory Taylor	Director General, Office of Public Health Practice, Public Health Agency of Canada	IPPH
Mr. Michael Clarke	Director, Information and Communication Technologies for Development, International Development Research Centre	IPPH
Dr. Catherine McCourt	Director, Health Surveillance and Epidemiology Division, Public Health Agency of Canada	IHDCYH
Ms. Claire Fortier	Former Vice-President, Grants and Finance, SickKids Foundation	IHDCYH

Name	Affiliation	Institute
Dr. Vyta Senikas	Associate Executive Vice-President, Society of Obstetricians and Gynaecologists of Canada	IHDCYH
Ms. Marie-Adèle Davis	Executive Director, Canadian Paediatric Society	IHDCYH
Dr. Neil Hagen	Professor, Department of Oncology, Medicine and Clinical Neurosciences, University of Calgary	ICR
Dr. Simon Sutcliffe	Chair, Canadian Partnership Against Cancer	ICR
Dr. Michael Wosnick	Scientific Director, Canadian Cancer Society Research Institute	ICR
Dr. Beth Jackson	Manager, Innovations and Trends Analysis Division, Public Health Agency of Canada	IGH
Ms. Linda Piazza	Director of Research, Heart and Stroke Foundation of Canada, Ottawa	IGH
Ms. Cindy Moriarty	Director, Programs Management Division, Health Canada	IGH
Dr. Peter Tugwell	Professor, Medicine, Epidemiology and Community Medicine, University of Ottawa	IMHA
Mr. Steve McNair	President and CEO, Arthritis Society of Canada	IMHA
Dr. John O'Keefe	Editor-in-Chief, *Journal of the Canadian Dental Association*	IMHA
Dr. Famida Jiwa	President and CEO, Osteoporosis Canada	IMHA
Mr. Paul Shay	National Executive Director, Kidney Foundation of Canada	INMD
Dr. Steve Vanner	Vice-President, Research Affairs, Canadian Association of Gastroenterology	INMD
Ms. Kimberly Elmslie	Director General, Centre for Chronic Disease Prevention and Control, Public Health Agency of Canada	INMD
Mr. Ian Potter	Former Assistant Deputy Minister, First Nations and Inuit Health Branch, Health Canada	IAPH
Dr. Suzanne Tough	Scientific Director, Alberta Centre for Child, Family and Community Research	IAPH
Dr. André Corriveau	Chief Medical Officer of Health, Government of Alberta	IAPH
Dr. Durhane Wong-Rieger	President, Canadian Organization for Rare Disorders	IG
Dr. Cindy Bell	Executive Vice-President, Corporate Development, Genome Canada	IG

References

[1] *CIHR Act*, 48-49 Elizabeth II Chapter 6 (2000). [Internet] [cited 2011-05-22]. Available from: http://www2.parl.gc.ca/HousePublications/Publication.aspx?DocId=2330441&Language=e&Mode=1&File=25.

[2] Health Portfolio, Health Canada, Government of Canada [Internet] [cited 2011-05-22]. Available from http://www.hc-sc.gc.ca/ahc-asc/minist/portfolio/index-eng.php.

[3] Canadian Institutes of Health Research. Year 5 – International Review Panel Report, 2000-2005. [Internet] [cited 2011-05-22]. Available from: http://www.cihr-irsc.gc.ca/e/31680.html.

[4] Canadian Institutes of Health Research. Strategy for Patient-Oriented Research [Internet] [cited 2011-05-22]. Available from: http://www.cihr-irsc.gc.ca/e/41204.html.

[5] In the federal budget tabled on March 22, 2011, the Government of Canada committed up to $100M to help establish the Canada Brain Research Fund. Due to the recent federal election, this budget was not approved by Parliament. At the time of drafting this report, the federal budget had not yet been re-introduced.

[6] Canada Foundation for Innovation's 2009-10 Annual Report. Available from: http://www.innovation.ca/en/accountability/annual-reports.

[7] Indirect Costs Program – Grant Calculations [Internet] [cited 2011-05-22]. Available from: http://www.indirectcosts.gc.ca/calculations/index_e.asp.

[8] Higher Education Funding Council for England, 2014 Research Excellence Framework – Decisions on assessing research impact, March 2011. [Internet] [cited 2011-05-22]. Available from: http://www.hefce.ac.uk/research/ref/pubs/2011/01_11/01_11.pdf.

[9] Alan I. Leshner. We Need to Reward Those Who Nurture a Diversity of Ideas in Science. The *Chronicle of Higher Education*. March 6, 2011. Available from: http://chronicle.com/article/We-Need-to-Reward-Those-Who/126591/.

[10] A. Bush. Evidence-based medicines for children: important implications for new therapies at all ages. *European Respiratory Journal*. 2006; 28:1069-1072.

[11] Anne D. Lyerly, Margaret O. Little and Ruth Faden. The second wave: Toward responsible inclusion of pregnant women in research. *International Journal of Feminist Approaches to Bioethics*. 2008; 1(2):5-22.

[12] Canadian Institutes of Health Research. Strategy on Patient-Oriented Research [Internet] [cited 2011-05-22]. Available from: http://www.cihr-irsc.gc.ca/e/41204.html.