INTEGRATING THE PHYSICAL AND APPLIED SCIENCES INTO HEALTH RESEARCH

A workshop sponsored by the
Canadian Institutes of Health Research (CIHR),
Institute of Genetics and Institute of Neurosciences,
Mental Health and Addiction in partnership with the
Institute of Cancer and the Institute of Infection and
Immunity

VANCOUVER

September 19-21, 2003

Four CIHR Institutes Join Forces to Improve the Health of Canadians by More Effectively Exploiting Research Excellence in the Physical and Applied Sciences

A two-day workshop was held in Vancouver in September 2003 to establish a plan of action for improving the health of Canadians by accelerating the translation of research breakthroughs in the physical and applied sciences into health research and clinical practice. The workshop, entitled "Integrating the Physical and Applied Sciences into Health Research", was hosted by the following two institutes within the Canadian Institutes of Health Research (CIHR) in partnership with two additional CIHR institutes:

Host Institutes

CIHR Institute of Genetics

The CIHR Institute of Genetics support research on the human and other genomes and on all aspects of genetics, basic biochemistry and cell biology related to health and disease, including the translation of knowledge into health policy and practice, and the societal implications of genetic discoveries.

Primary areas of research include (i) the human genome, (ii) genetic determinants of health, polymorphisms, genetic epidemiology and gene-environment interactions, (iii) interventions including health promotion, disease prevention and health services delivery, (iv) clinical genetics (diagnostics, genetic counseling, treatment), (v) pathogenesis and mechanisms of disease and dysfunction related to gene function, (vi) molecular biology and genetics: gene identification, sequencing, structure and function, regulation, gene-gene and gene-genome interactions, (vii) gene products, proteomics, protein chemistry, structural biology, (viii) comparative genomics involving model organisms, (ix) technology development in genomics (e.g. microarray, sequencing) and application as health technologies and tools, (x) bioinformatics, and (xi) ethics issues related to research, care strategies, and access to care (e.g. population screening, privacy and use of genetic information, community and population-based risk management strategies).

CIHR Institute of Neurosciences, Mental Health and Addiction

The CIHR Institute of Neurosciences, Mental Health and Addiction supports research to enhance mental health, neurological health, vision, hearing, and cognitive functioning and to reduce the burden of related disorders through prevention strategies, screening, diagnosis, treatment, support systems, and palliation. Associated research advances our understanding of human thought, emotion, behavior, sensation (sight, hearing, touch, taste, and smell), perception, learning and memory.

Primary areas of research include (i) mental health and neurological health promotion policies and strategies, (ii) addiction prevention policies and strategies, (iii) health determinants, (iv) identification of health advantage and health risk factors related to the interaction of environments (cultural, social, psychological, behavioral, physical, genetic), (v) disease, injury and disability prevention strategies at the individual and population levels, (vi) head injury prevention, treatment, and rehabilitation, (vii) addiction, mental health, and dysfunction of the nervous system affecting sensation, cognition, emotion, behavior, movement, communication, and autonomic function, (viii) clinical research and

health outcomes research into diagnostic technologies and methods, therapies, treatment, care, and rehabilitation models (long and short-term), (ix) co-morbidity of conditions and impacts on prevention, diagnosis, treatment, care and rehabilitation, (x) design and implementation of health services delivery - from prevention, to screening, to diagnosis, to intervention or treatment, to rehabilitation, to palliation, (xi) development and implementation of health technologies and tools (e.g. imaging, bio-engineering, drug delivery technologies), (xii) development, regulation, function and dysfunction of the central, peripheral, and autonomic nervous systems, (xiii) human psychology, cognition and behavior, sleep and circadian biology, and pain, and (ixv) ethics issues related to research, care strategies, and access to care (e.g. informed consent, hospitalization, addiction, mental health and the justice system).

Partnering Institutes

CIHR Institute of Cancer Research

The CIHR Institute of Cancer Research supports research in Canada to reduce the burden of cancer on individuals and families through prevention strategies, screening, diagnosis, effective treatment, psycho-social support systems, and palliation.

CIHR Institute of Infection and Immunity

The CIHR Institute of Infection and Immunity supports research to enhance immune-mediated health and to reduce the burden of infectious disease, immune-mediated disease, and allergy through prevention strategies, screening, diagnosis, treatment, support systems, and palliation.

INTEGRATING THE PHYSICAL AND APPLIED SCIENCES INTO HEALTH RESEARCH WORKSHOP

September 19-21, 2003

Executive Summary

WORKSHOP OVERVIEW AND MOTIVATION

From September 19-21, 2003, the Institute of Genetics (IG) and the Institute of Neurosciences, Mental Health and Addiction (INMHA) of the Canadian Institutes of Health Research (CIHR) - in partnership with the Institute of Cancer Research (ICR) and the Institute of Infection and Immunity (III) - convened more than fifty-five leading researchers from the physical, applied and health sciences, plus representatives from the relevant funding agencies [Canadian Institutes of Health Research (CIHR), Natural Sciences and Engineering Research Council of Canada (NSERC), National Institutes of Health (NIH), Canadian Genetic Diseases Network (CGDN), Health Canada (HC), National Research Council (NRC)] in a focused workshop to:

- Identify research trends in the physical and applied sciences and opportunities for exploiting advances in these research disciplines to improve the health of Canadians
- Discuss funding opportunities and means of ensuring the continued growth of physical and applied science in health research
- Define how to best foster effective interdisciplinary research and training involving collaborations between physical and applied scientists and health researchers
- Identify mechanisms that will facilitate productive communication between these research communities

The workshop was structured into several sessions, each focused on a particular aspect of the functional integration of the physical and applied sciences into health research:

- Current research trends
- Research communities
- Funding
- Fostering effective interdisciplinary research & training

A series of key recommendations to CIHR and NSERC – along with a set of proposed actions - emerged from a synthesis of the discussions held over the two-day meeting.

AGENDA AND PARTICIPANTS

The workshop organizing committee, agenda and participant list are available in Appendices A, B and C, respectively. Summaries of the content and desired outcomes of the four major workshop sessions are provided below:

Current Research Trends

Acknowledging the enormous breadth implicit in the title of the workshop, eight topics were chosen to illustrate where physical and applied sciences have made and are making significant inroads and impact in health research, and where health research sees a role for the physical and applied sciences.

In this session, leading researchers from the fields of biophotonics, nanotechnology, micro- and macro-instrumentation, physics and chemistry described new innovations in their fields, where they see their respective fields heading over the next five to ten years, and how they see their fields - and innovations in their fields - helping health research. Similarly, health researchers with expertise in microbial and eukaryotic systems, and genomics discussed how they see their fields developing and advancing and where they see needs and opportunities for the physical and applied sciences.

From these presentations and follow-up round-table discussions, the workshop participants identified critical areas of health research where research programs involving physical and applied scientists would accelerate progress, and then identified ways to better and more quickly inform the physical and applied science research community of opportunities and needs in health research.

Research Communities

Currently, research collaborations between experts in the physical and applied sciences and those in health research are most often formed in response to a “Request for Applications” (RFA) where interdisciplinary research is valued. While there are certainly examples of scientific and engineering breakthroughs resulting from collaborations formed in this manner, too often the collaboration is created on paper to improve the potential for successful funding of the application, with relatively little attention paid to strengthening the partnership before or after the grant writing stage. This recurring problem is due in part to the current disconnect (albeit slowly diminishing) between the physical and applied science research community and those disciplines that are traditionally thought to comprise the health research community.

Discussions in this session therefore centered on the current opportunities and barriers to more effective and successful integration of these two broad research communities, including coordination between the funding organizations for each community: NSERC for physical and applied scientists and CIHR for health researchers.

Funding

An underlying theme of this workshop was to determine how Canada can best establish a long-term funding strategy that will support and sustain interdisciplinary research that integrates the physical and applied sciences into health research in productive, innovative, and collaborative programs.

In a focus session, representatives from the Canadian Institutes of Health Research (CIHR), Natural Sciences and Engineering Research Council (NSERC), Genome Canada and the U.S. National Institutes of Health (NIH) described current and planned mechanisms of support. This provided a context for a roundtable and open discussion on Canada’s future needs for effective sustainable funding programs, including the establishment of appropriate scientific review panels, projections on the magnitude of required total funding, and optimal configuration of funding programs.

Fostering Effective Interdisciplinary Research & Training

A long-term strategy for improving the health of Canadians through research that integrates the physical and applied sciences into health research must rely on the training of a new generation of scientists with the ability to bridge these fields, to understand both cultures and languages, to understand what the physical and applied sciences have to offer, and to grasp the challenges presented by the fields of biology that can benefit from technological advances. Some successful examples of creating training and research programs at the interface between the life sciences and the physical and applied sciences were presented and discussed in the broader context of general mechanisms that work.

RECOMMENDATIONS

The translation of discoveries by physical and applied scientists into the life sciences has, to a considerable extent, dictated the style and pace of health research over the last quarter century. High-throughput DNA sequencing technology, ESI and MALDI-TOF mass spectrometry, multi-photon correlation laser spectroscopy, and atomic force microscopy are but a handful of the many technologies developed by physical and applied scientists that have revolutionized the manner in which health research is conducted. Recognition of the importance of this connection between breakthroughs in health research and fundamental research in the physical and applied sciences suggests that considerable good would come from (1) more actively informing the physical and applied science research community of the current needs of health research, and (2) supporting research conducted by or involving PIs from the physical and applied science community that effectively addresses the specific needs of health research.

A central goal of this two-day workshop was to provide a set of recommendations to the CIHR and NSERC for improving the quality, quantity and overall impact of health research in Canada led by or involving physical and applied scientists. These recommendations are intended to provide CIHR and NSERC with a framework for accelerating the discovery of new technology and the translation of that technology to the solution of pressing problems in medical science.

1. The CIHR in collaboration with NSERC should be proactive in identifying emerging and established fields of physical and applied science that have the potential to make or are already making important contributions to health research.

Fields that should be recognized include:

Functional Imaging

Novel imaging tools and techniques are under development and refinement to allow researchers to better address important questions related to health and human biology. These tools cover the breadth of necessary imaging scales, from tracking of single protein motion in cells and fluids to functional imaging on organ and whole body length scales.

Nanotechnology

Nanoscience is an emerging science for which there is no road map for development, particularly with respect to health research. The tools of nanoscience are currently being applied to address fundamental issues related to

biomolecular structure and function; however, novel nanomaterials for therapeutic applications remain a distant but potentially important goal.

Micro-fluidics Based Instrumentation

The integration of microfluidics with surface chemistry has led to tremendous success in the form of gene chips and, more recently, protein chip applications. These technologies, along with a number of promising microfluidics-based lab-on-a-chip instruments under development, provide an excellent example of how physical and chemical sciences have combined to provide a tremendous improvement in the way health-research and clinical diagnostics are conducted.

Spectroscopy of Biological Systems

Spectrometry, particularly the various modes of mass spectrometry and NMR spectroscopy, is central to progress in health research. New advances in MS are anticipated from current research in the physical and applied sciences, including improved integration with high-resolution separation processes, novel ion detection schemes, and resolution of instrumentation miniaturization issues. Similarly, we are currently witnessing dramatic improvements in the power and range of application of NMR spectroscopy, as well as in other modes of spectroscopy, such as UV resonance Raman spectroscopy, and their application to health research.

Technology Development for Health Research

A common and important goal throughout all areas of technology development for health research is that of cost reduction, but with attendant increases in resolution and speed. Improving the sensitivity and throughput, while reducing the cost, of current work-horse technologies of health research, including high-throughput DNA sequencers, peptide sequencers and protein mass-mapping systems, is central to progress in systems biology and the full realization of its potential in health research (see below).

This list is not intended to be exhaustive or exclusive. As areas of physical and applied science research, as well as health research, are constantly evolving, the CIHR and NSERC must remain proactive in evaluating research in the physical and applied sciences that should be supported to accelerate advances in medical practice.

2. The CIHR should be proactive in identifying important areas of health and health-related research where the involvement of the physical and applied science research community is essential to progress.

A key conclusion of the workshop was the realization that the physical and applied sciences can make and have already made seminal contributions to the advancement of health and health research in Canada. Illustrative areas of health research where significant and sustained contributions from physical and applied scientists are clearly required to achieve or accelerate progress include:

Chemical Biology

Recent advances in molecular biological, chemical, and biophysical techniques are presenting us with spectacular opportunities both to increase our understanding of biological systems at the molecular level and to attack medical problems by, for example, designing and constructing small molecules as spectroscopic probes, functional congeners, and diagnostic and therapeutic

agents. As a result, major advances in biology and medicine will likely originate through collaborations between those disciplines able to create and apply an integrated combination of chemical, structural, biophysical, computational, and molecular biological methods to critical areas of human health.

Microbial Systems

There are clear needs from the microbial research community for tools that work well with the specific requirements of their systems: namely, the ability to probe microbes in their natural environments and within soil microcosms. This will require development and validation of new proteomics and genomics tools, including new forms of sample separation and mass spectrometry that allow global and temporal studies of these systems in their natural environment.

Integrative Functional Genomics

The creation of genetic and interaction networks are enabling researchers to rapidly identify possible pathways for disease. However, the utility and pace of this emerging field are limited by instrumentation and analytical challenges associated with working with vast amounts of MS interaction data that compromise proper annotation and curation of the data. Many interactions are more complex than what is currently modeled and faster and lower cost methods are now required to properly identify and correctly annotate these networks.

Single-cell Systems Biology

The development of technology and instrumentation capable of dissecting genome and proteome responses in single cells would enable statistical analysis of the variations in individual cell responses, as opposed to measuring the average response of a cell population as is currently practiced. The ability to probe at the single cell level has far-reaching implications. For example, the technology may be applied to cataloging the cellular heterogeneity in the central nervous system, to monitor embryo development or cellular differentiation, or to observe pharmacokinetics in single rare cells, such as chemotherapy-resistant cells or adult stem cells. The technology would also improve clinical practice, such as detection of cancer. Cell-to-cell variability in a tumor increases as the disease progresses. Proteome maps from a hundred individual tumor cells could therefore be used to generate a molecular index that provides prognostic information to guide patient therapy.

3. The CIHR and NSERC should jointly establish and widely publicize programs to rapidly inform physical and applied scientists about current research opportunities and needs in health research.

Proposed action items to realize this recommendation include:

- Organizing and supporting pre-grant networking opportunities between health researchers and physical and applied scientists. Workshops that provide (1) physical and applied scientists with an understanding of the needs of health research, and (2) health scientists with a vision of new technology under development are particularly important.

- Simplifying the CIHR and NSERC websites to help new applicants identify important upcoming competitions/RFAs supporting interdisciplinary health research and the application of physical and applied science to human health issues

- Establishing a national database on research profiles, programs and expertise (possibly using the Common CV as a information source), emphasizing those researchers whose research embodies the interdisciplinary themes of CIHR and NSERC

4. The CIHR and NSERC should strengthen programs that accelerate the formation of potent cross-disciplinary teams of investigators

Proposed action items to realize this recommendation include:

- Better address the challenges experts in one discipline face when seeking to contribute to the goals of another by extending existing career transition awards and interdisciplinary initiatives to institute-wide level. Biological questions often have multi-layer complexity that needs to be understood by physical scientists proposing to make contributions to health research.

- Support health researchers in hiring and training HQ physical and applied scientists in their labs. NSERC should be encouraged to support similar cross-disciplinary HQP training opportunities for health researchers in the physical and applied sciences.

- Provide a seed-fund program to support formation of interdisciplinary health-research teams and proof-of-concept data acquisition

- Encourage cross-disciplinary collaborations between CIHR, NSERC, and SSHRC researchers by actively soliciting support from SSHRC for the Collaborative Health Research Projects (CHRP) and related interdisciplinary research programs

- Encourage universities and research institutions to find ways to facilitate the interaction between the natural sciences, engineering and health research. Many universities are developing initiatives that blur the traditional concept of departmental boundaries, especially for graduate studies. This includes encouraging cross-faculty and cross-departmental participation in CIHR Training Group Programs.

5. The CIHR should recognize the Collaborative Health Research Projects (CHRP) program as a critical first step in supporting interdisciplinary health research and, in collaboration with NSERC, commit to expanding and sustaining the CHRP program over the next decade.

Proposed action items to realize this recommendation include:

- Evaluate the success of the existing CHRP program by identifying challenges and limitations (programmatic, rather than financial) faced by participants, reviewers, and the participating councils. Establish metrics for the CHRP program, which may include: number of applications to the program (and growth in the number of applications per funding cycle since inception as an NSERC program and now in the current round as a co-funded program), breadth of research, outcomes (successful or not) of research programs, breadth of participants background, perceived impact on community.

- The CHRP program should support two annual competitions: the first (hereafter referred to as the CHRP operating grant program) designed to fund operating grants submitted by physical and applied scientists or by a small research team that includes physical and applied scientists proposing realizable, important health research; the second (hereafter referred to as the CHRP group grant program) designed to fund at a higher level a small number of interdisciplinary teams proposing large-scale (e.g. systems biology type) research projects that have the potential to achieve high-impact results that can demonstratively improve the health of Canadians.

- With equal support from CIHR and NSERC, over the next four years, the annual budget of the CHRP operating grant program should grow to support a total of 50 projects nationwide at an average annual budget of $200,000 per grant.

- With equal support from CIHR and NSERC, over the next two years, the CHRP group grant program should be established to fund a total of 10 large-scale projects nationwide at an average annual budget of $500,000 per grant.

- The commitment by both CIHR and NSERC to the CHRP program should not negatively impact the overall budget of CIHR and / or NSERC intended for open competition. It is critically important that commitment by both CIHR and NSERC to increased sustained funding for the CHRP program not divert funding away from highly meritorious operating grant proposals at other review panels. The overarching goal is that the best research be funded in Canada.

- Establish a funding mechanism for very early stage high risk innovative research (analogous to the New Discoveries – High Risk Grants RFA offered by the Institutes of Genetics, and Neurosciences, Mental Health, and Addiction), recognizing that such funding is, in part, intended to serve as a feeder program to the two CHRP grant competitions by funding for up to 12 months early-stage health-related research. This could be accomplished by adding a dedicated funding stream within the CHRP for early stage high risk innovative research.

- The program should be recognized by the CIHR and all applicants as a directed competition to encourage the development of high-caliber interdisciplinary research teams with innovative ideas and potential to improve the health of Canadians, and to support physical and applied scientists proposing a promising strategy to address a current healthcare issue.

6. The management and review process of interdisciplinary health research and team science initiatives must insure that the funding program supports the most deserving applicants

The CHRP program can be highlighted as a best practice as it includes the key elements outlined below:

- Establish a dedicated interdisciplinary review committee of 12 members with 4 year appointments that draws on the strengths of NSERC to identify outstanding physical and applied scientists, CIHR to identify outstanding health researchers, and both NSERC and CIHR to identify outstanding interdisciplinary researchers, and the combined committee to assess the overall quality of the proposed research, the strength and suitability of the proposed team of researchers, and the likelihood of success.

- Recognize that an outstanding PI in the physical and applied sciences can lead important health research.

- When evaluating grants from physical and applied scientists proposing the development of new technology, emphasize the health-related questions to be answered. That is, rather than tailoring the question to the tool, the applicant should recognize that the properties and performance of the tool/technology must be defined in terms of the health research question(s) to be answered.

- Recognize the importance of rapid identification and application of new technologies in health research by openly and enthusiastically supporting well-justified requests from health researchers for salary support for senior (PDFs, research associates) physical and applied scientists needed to drive in-house identification, development, installation and application of new technology essential to achieving the stated health research goals of the PI.

- Recognize the special review needs of applications proposing team science:

    a) Establish a policy that each application must be evaluated by a sufficient number of external referees from both the physical and applied sciences, and life sciences sectors to assess the overall merit of the proposed research and the ability of each team member to fulfill their respective research responsibilities.

    b) Recognize that PIs, PDFs and students working on a team project are often expected to advance their primary discipline and department by establishing a more equitable method for PIs on small-team and group-grant supported projects to receive appropriate credit.

    c) Identify metrics to be used within the review committee to objectively evaluate the quality and impact of the research and vitas of collaborating PIs from different disciplines.

- Both proposed CHRP grant programs should commit to broad and balanced funding of all areas of physical and applied science that can, either directly or in the future, contribute to better health of Canadians.

7. Improve linkages between major funding agencies (CIHR, NSERC, SSHRC, Genome Canada, CFI) supporting interdisciplinary health research to affect necessary change

Proposed action items to realize this recommendation include:

- Establish an Inter-Agency Strategic Planning Panel for Interdisciplinary Health Research and empower it with the ability to rapidly respond to health research needs through organization and funding of appropriate research teams.

- Exploit the inherent power embodied in that committee to lobby federal and provincial governments in a unified voice advocating significantly higher investment in interdisciplinary research to solve Canada's current and emerging health-research concerns to government.

- Better educate the Canadian people to facilitate a culture change that recognizes and supports the demonstrated and potential impact of health research led by or including physical and applied scientists.

- Identify and facilitate opportunities to communicate success to the public and decision-makers.

- Establish inter-agency policies and programs that encourage Canadian industry to support health-motivated research in the laboratories of physical and applied scientists.

    a) Establish a matching fund program that allows industry to partially support cross-disciplinary training of physical and applied scientists with the aim of creating a better skilled employee pool.
    b) Identify ways to encourage industry to become better at advocating for discovery research.
    c) Emphasize that interdisciplinary health research will result in new creative ideas / concepts / devices / strategies for health that will foster and attract industry investment.

8. An Interim Planning and Priorities Committee should be established within the CIHR Institute of Genetics, comprising researchers drawn from both CIHR and NSERC pools, with the responsibility to oversee implementation of the above recommendations and follow-up as needed

Proposed action items to realize this recommendation include:

- An interim "Integrating the Physical and Applied Sciences into Health Research" planning and priorities committee will comprise all members of the Vancouver Workshop organizing committee [Philip Hieter (UBC), Christopher Yip (Toronto), Yves De Koninck (Laval), John-Bruce Green (Alberta), and Charles Haynes (UBC)], as well as Dr. Brenda Andrews (Toronto) and Dr. Roderick R. McInnes (CIHR Institute of Genetics).

- The interim planning and priorities committee will make implementation of recommendations 5, 6, and 7 its top priorities, and will then address implementation of the remaining recommendations.

Appendix A

WORKSHOP ORGANIZING COMMITTEE

Yves De Koninck
Université Laval

John-Bruce Green
University of Alberta

Charles Haynes
University of British Columbia

Philip Hieter (Co-Chair)
University of British Columbia

Christopher Yip (Co-Chair)
University of Toronto

Appendix B

WORKSHOP AGENDA

September 19, 2003		
7:30 pm – 10:00 pm	**Welcoming Reception & Registration**	Azure & Foyer
September 20, 2003		
7:00 am – 7:45 am	**Continental Breakfast**	Junior AB Foyer
7:45 am – 8:00 am	**Welcoming & Introductory Remarks** *Philip Hieter and Christopher Yip,* Co-Chairs, IG Integrating the Physical and Applied Sciences into Health Research Priority and Planning Committee *Remi Quirion*, Scientific Director, Institute of Neurosciences, Mental Health and Addiction, CIHR *Roderick McInnes*, Scientific Director, Institute of Genetics, CIHR	Junior AB
8:00 am – 8:15 am	**Goals & Background** *Discussion Leaders:* Philip Hieter, University of British Columbia Christopher Yip, University of Toronto	Junior AB
8:15 am – 10:20 am	**Current Research Trends** (20 minutes plus 5 for Q&A) *Discussion Leader:* Jed Harrison, University of Alberta ▪ *Biophotonics: From fundamentals to applications* - Lothar Lilge, University of Toronto & Paul Wiseman, McGill University ▪ *Nanotechnology* – Peter Grutter, McGill University ▪ *Micro-instrumentation* – Jed Harrison, University of Alberta ▪ *Macro-instrumentation* – Werner Ens, University of Manitoba ▪ *Chemical Biology* - Stephen Withers, University of British Columbia	Junior AB
10:20 am – 10:45 am	**Break**	Junior AB Foyer
10:45 am – 12:15 pm	**Current Research Trends (continued)** *Discussion Leader:* Marco Marra, British Columbia Cancer Research Centre ▪ *Microbial systems*– Julian Davies, University of British Columbia ▪ *Eukaryotic Systems*– Michael Tyers, Samuel Lunenfeld Research Institute	Junior AB

	▪ *Technology Development in Genomics* - Andre Marziali, University of British Columbia	
12:15 pm – 1:00 pm	**Lunch**	Junior AB
1:00 pm – 2:00 pm	**Research Communities** *Discussion Leaders:* Ulrich Krull, University of Toronto David Wishart, University of Alberta *Plenary Discussion:* Identification of Canadian research strengths and strategies for fostering these areas	Junior AB
2:00 pm - 3:30 pm	**Funding** (10 minutes plus 5 for Q&A) *Discussion Leader:* Joel Weiner, University of Alberta ▪ *NSERC Funding Opportunities* - Krystyna Miedzybrodzka, Director, Bio-Industries, NSERC ▪ *CIHR Funding Opportunities* - Mark Bisby, VP Research, CIHR ▪ *NSERC/CIHR Collaborative Health Research Projects (CHRP) program* – Krystyna Miedzybrodzka, Director, Bio-Industries, NSERC *&* Mark Bisby, VP Research, CIHR ▪ *Regenerative Medicine and Nanomedicine RFA* – Remi Quirion, Scientific Director, Institute of Neurosciences, Mental Health and Addiction (INMHA), CIHR ▪ *Novel Technology Applications in Health Research RFA* - Bhagirath Singh, Scientific Director, Institute of Infection & Immunity (III), CIHR ▪ *Genome Canada's Applied Genomics and Proteomics Research in Human Health RFA* – Alex Mackenzie, VP, Research, Genome Canada ▪ *National Institutes of Health (NIH)* - Jeff Schloss, Program Director, Technology Development Coordination, National Human Genome Research Institute, National Institutes of Health (NIH)	Junior AB
3:40 pm – 4:00 pm	**Break**	Junior AB Foyer
4:00 pm - 5:30 pm	**Funding (continued)** *Discussion Leader:* Joel Weiner, University of Alberta Table Discussions (45 minutes): ▪ Sustainability and growth of overall funding for research at this interface Table Reports & Plenary Discussion (45 minutes)	Junior AB

7:30 pm – 9:30 pm	**Dinner & Keynote Speech** *Nanosystems Biology* James Heath California Institute of Technology	Junior D
9:30 pm – 11:00 pm	**After Dinner Reception**	Azure and Foyer
September 21, 2003		
7:30 am - 8:30 am	**Continental Breakfast**	Junior AB Foyer
8:30 am – 10:00 am	**Fostering Effective Interdisciplinary Research & Training** *Discussion Leader:* Yves De Koninck, Université Laval ▪ *Interdisciplinary Research*, Tim Hughes, University of Toronto ▪ *Interdisciplinary Training Programs,* Yves De Koninck, Université Laval *Plenary Discussion:* How to be proactive in establishing a productive interdisciplinary research program	Junior AB
10:00 am – 10:30 am	**Break**	Junior AB Foyer
10:30 am – 11:50 am	**Summary & Wrap-Up** *Discussion Leaders:* John-Bruce Green, University of Alberta Charles Haynes, University of British Columbia ▪ Recapping the goals of the meeting ▪ Summary of the previous day *Plenary Discussion:* Synthesizing the discussions held over the past day and half, with a focus on next steps – i.e., Five essential action items	Junior AB
11:50 am – 12:00 pm	**Closing Remarks & Adjournment** *Philip Hieter and Christopher Yip,* Co-Chairs, IG Integrating the Physical and Applied Research into Health Research Priority and Planning Committee *Joel Weiner*, Institute Advisory Board Chair, Institute of Genetics, CIHR	Junior AB

Appendix C

PARTICIPANT LIST

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