

# STRATEGIC PLAN 2021–2026

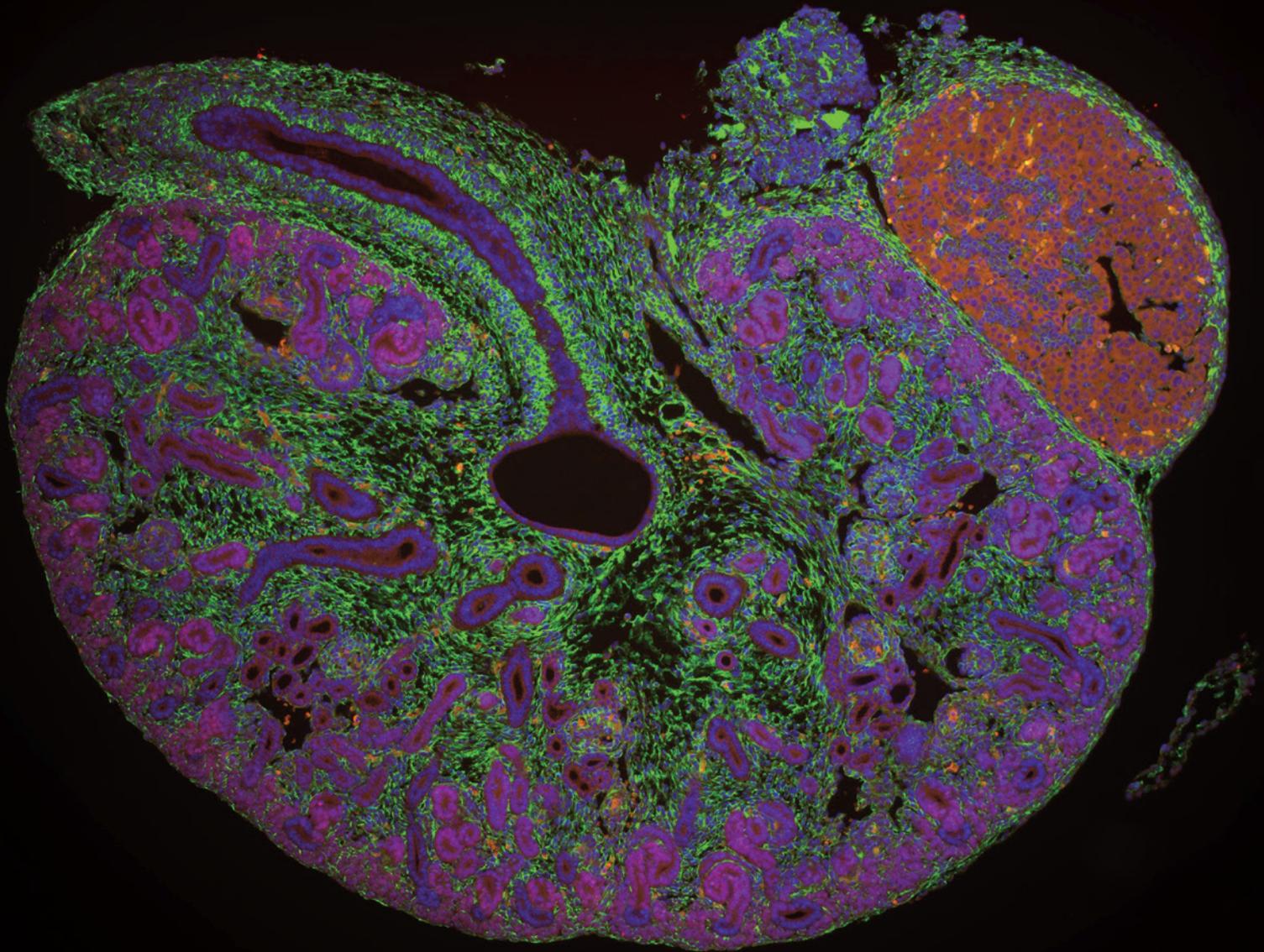
**THE BEST HEALTH FOR ALL,  
POWERED BY OUTSTANDING RESEARCH**





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Fetal mouse kidney featuring developing nephrons and collecting system with adjacent adrenal gland

## Message from the Scientific Director

The world has changed dramatically since I began my term as INMD Scientific Director in January 2018 and engaged our Institute Advisory Board to generate a new INMD strategic plan. Clearly the COVID-19 pandemic has impacted every aspect of day-to-day life in Canada. The COVID-19 pandemic has served to highlight the critical importance of science and the health research enterprise in Canada and globally, and the need for adaptation and innovation within the Canadian health care system.

COVID-19 has created an additional burden for individuals with preexisting conditions and diseases in the INMD mandate, namely obesity, diabetes, kidney and liver disease. People with these conditions are more severely affected by COVID-19. Before the COVID-19 pandemic, these conditions already represented a significant burden of disease among Canadians and disproportionately affect some population groups. In this context, it is timely for us to redouble our efforts towards developing effective prevention and treatment strategies. Further, the social isolation and socioeconomic burdens that have resulted from COVID-19 present an added sense of urgency and an opportunity for us to address societal factors that threaten food security, mobility in our neighborhoods, and access to timely and high quality health care. These factors are fundamentally important to the health of those affected by INMD-related conditions.

As the INMD Institute Advisory Board (IAB) was developing the new strategic plan, INMD focused on the development of a strategic research initiative to commemorate the 100<sup>th</sup> anniversary of the discovery of insulin being marked in 2021. This research initiative, *100 Years of Insulin: Accelerating Canadian Discoveries to Defeat Diabetes*, is an aspirational initiative that brings together international and national partners, and involves 10 of CIHR's 13 Institutes working together to tackle the challenge of diabetes in its varied dimensions. We have also championed the development of CIHR's new Health Research Training Platform Pilot, which will support integrated training and mentoring environments to position health research trainees and Early Career Researchers for career success.

The new INMD Strategic Plan aligns with CIHR's new Strategic Plan 2021-2031 and priorities, and will contribute to CIHR meeting its overall objectives in key areas such as health equity, capacity development, supporting Indigenous Peoples' health, interdisciplinary research, and team science. It will also support emerging science policy issues identified in CIHR's Strategic Plan, such as inclusive concepts of research excellence, promotion of open science and inclusion of equity, diversity and inclusion.

This plan builds on past INMD successes, and will engage partners, create new opportunities for the research community, and most importantly, contribute towards improving the health of Canadians. Our vision is to 'catalyze world-leading research that promotes optimal and equitable nutrition and metabolic health outcomes for Canadians'. This vision will drive an ambitious strategic plan that spans discovery, therapeutics, and translation with a particular focus on heterogeneity, health equity, and capacity within our research community.

To achieve this vision, INMD will bring together stakeholders to identify shared objectives and co-create meaningful and effective initiatives and maximize opportunities for the mobilization of knowledge. I look forward to working with INMD partners, both national and international, to implement our new INMD Strategic Plan in the coming years.

Yours in good health!



Norman Rosenblum, MD, FRCPC, FCAHS  
Scientific Director  
CIHR – Institute of Nutrition, Metabolism  
and Diabetes

A close-up of a human eye, looking slightly to the right. The eye is overlaid with a futuristic, blue digital interface. The interface consists of several concentric circles and lines, resembling a camera lens or a sensor array. The overall color palette is dominated by shades of blue and white, with a soft, ethereal glow. The text "WHERE are we now?" is positioned in the upper right quadrant of the image.

**WHERE**  
are we now?

## About CIHR

The Canadian Institutes of Health Research (CIHR) is Canada’s federal funding agency for health research. CIHR is comprised of 13 virtual Institutes that collectively deliver on CIHR’s mandate: 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.

CIHR is entering into a new period in its development. The CIHR Strategic Plan 2021 – 2031 outlines ambitious new priorities designed to enhance knowledge creation, knowledge mobilization, health equity and capacity building. CIHR will move as one part of Canada’s broad health research ecosystem, to achieve change that is both transformational and sustainable.

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

As one of CIHR’s 13 Institutes, INMD engages the research community, including researchers, health professionals, voluntary health organizations, provincial health organizations, international research funders, industry and patient groups, and encourages interdisciplinary, integrative health research along the spectrum of basic discovery, clinical research, health services and population health and policy.

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## The INMD Mandate

The Institute of Nutrition, Metabolism and Diabetes supports research to enhance health in relation to diet, digestion, excretion, and metabolism, and addresses causes, prevention, screening, diagnosis, treatment, support systems, and palliation of conditions and problems associated with hormone, digestive system, kidney, and liver function.

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INMD was the subject of an in-depth evaluation in 2017, and was found to be successfully addressing an “overwhelmingly challenging” mandate. The evaluation noted that the impact of many diseases within INMD’s mandate falls disproportionately on certain populations. The evaluation further highlighted the need to increasingly address the particular disadvantage of Indigenous Peoples of Canada. The panel concluded that the Institute was well positioned to look forward and address Canada’s major challenges in nutrition and metabolic health.

*“The evaluation found that the relevance of the mandate has been growing more important with the increasing levels of obesity and burden of chronic disease, largely diabetes. The Institute’s mandate covers important areas in the context of health of Canadians: nutrition, metabolism and diabetes all contribute significantly to general health and chronic conditions across the lifespan; diabetes, is a huge burden on the health care system in Canada and worldwide. INMD strives diligently to support the research community in the areas of priority, and this is reportedly valued by stakeholders, particularly by non-profit organizations and the public sector.”*

– Report of INMD Evaluation Panel, 2017

## Snapshot of Major Disease Burden in the INMD Mandate\*

### Diabetes

#### Prevalence

- In 2020, an estimated 3.8 million Canadians were living with diabetes (including both type 1 and type 2 diabetes)<sup>1</sup>.
- Certain populations are at higher risk of developing type 2 diabetes, including those of African, Arab, Asian, Hispanic, Indigenous, or South Asian descent<sup>1</sup>.
- In 2018, diabetes mellitus was the 7<sup>th</sup> leading cause of death in Canada<sup>2</sup>.

#### Health impact

- Increased risk of diabetes complications including cardiovascular disease, vision loss, kidney failure, nerve damage, limb amputations.
- Approximately 38% of patients who started renal replacement therapy had diabetes as the main cause of their kidney failure<sup>3</sup>.

#### Estimated Cost

- Direct costs to healthcare were estimated at 3.8 billion per year, with significant out of pocket costs to patients<sup>1</sup>.
- An Ontario study from 2004 to 2012 using a validated, population-based administrative diabetes registry found that over the 8 years of follow-up, incident diabetes was associated with more than double (~\$10,000) in excess healthcare costs compared to non-diabetes controls<sup>4</sup>.

### Obesity

#### Prevalence

- In 2018, an estimated 63% of Canadian adults<sup>5</sup> and 30% of children were overweight or obese<sup>6</sup>.
- Overweight/obesity is 1.5 times more prevalent among Indigenous adults living off-reserve<sup>7</sup>.
- Globally, high BMI ranked 4<sup>th</sup> among risk factors for mortality in 2017, primarily due to the effect of high BMI on cardiovascular disease. BMI prevalence continues to have one of the highest rates of increase over time<sup>8</sup>.

#### Health impact

- Increased risk of type 2 diabetes, asthma, cardiovascular disease, gallbladder disease, osteoarthritis, chronic back pain, and several types of cancer<sup>9</sup>.
- Complications of obesity include not only physical health problems but also psychological concerns (e.g., low self-esteem) and negative attitudes and stereotypes about those who are obese have been linked to social and employment discrimination<sup>9</sup>.

#### Estimated Cost

- In 2008 the annual economic burden of obesity in Canada was estimated to be \$4.6 B<sup>9</sup>.

\* The diseases and conditions featured here are the most prevalent among a host of disease states and conditions within the INMD mandate. Information presented is a limited snapshot based on the most recent nationally representative data, where available.

## Non-Alcoholic Fatty Liver Disease (NAFLD) and Non-Alcoholic Steatohepatitis (NASH)

### Prevalence

- It is estimated that NAFLD, a major cause of chronic liver disease, affects about 20% of the Canadian population and almost 3% of children<sup>10</sup>.
- It is estimated that 4% of Canadians have NASH (most severe form)<sup>11</sup>.

### Health impact

- NASH is associated with ongoing liver damage and can lead to cirrhosis of the liver, liver cancer, and the need for a liver transplant<sup>12</sup>.

### Estimated Cost

- It is estimated that lifetime direct costs of all adult NASH patients in the US in 2017 will be \$222.6 billion and the cost of the advanced NASH population will be \$95.4 billion USD<sup>13</sup>.
- A study of adults in 5 European countries based on patient-reported outcomes found that patients with NASH reported worse quality of life and more health care resource use, including more visits to healthcare professionals and Emergency Rooms and more hospitalizations, compared to the general population and a matched cohort of adults with type 2 diabetes<sup>14</sup>.

## Nutrition & Food Insecurity

### Prevalence

- In 2017-18, 1 in 8 Canadian households were found to be food insecure<sup>15</sup>, and based on 2014 data, 46.8% of households in Nunavut experience household food insecurity<sup>16</sup>.

### Health impact

- In 2017, one in five deaths globally, equivalent to 11 million deaths, were estimated to be associated with poor diet, and diet contributes to a range of chronic diseases with cardiovascular disease, cancers and type 2 diabetes being the leading causes of diet-related death<sup>17</sup>.
- Food insecurity is associated with higher mortality rates and these higher rates are especially pronounced for the most severe food insecure<sup>18</sup>.

### Estimated Cost

- Not meeting Canadian food recommendations was responsible for an estimated \$13.8 billion/year (direct health care: CAD\$5.1 billion, indirect: CAD\$8.7 billion), based on 2014 costs<sup>19</sup>.

## Chronic Kidney Disease (CKD)

### Prevalence

- Between 2007-2009, an estimated 12.5% of Canadian adults were living with CKD in Canada<sup>20</sup>, a condition for which there is no cure.
- Globally CKD ranks as the 12th leading cause of death out of 133 conditions and the prevalence of CKD reported in the Global Burden of Disease 2017 was 9.1% [95% Uncertainty Interval 8.5 to 9.8]<sup>21</sup>.
- In 2018, kidney disease was the 10<sup>th</sup> leading cause of death in Canada<sup>22</sup>.

### Health impact

- Diabetes and hypertension are key risk factors for CKD and increase treatment burden and decrease quality of life for people living with CKD.
- CKD is associated with very high risk of Coronary Artery Disease (CAD). CAD management is complicated in CKD patients, due to comorbid conditions and potential side effects during interventions<sup>23</sup>.

### Cost

- In 2014, hemodialysis cost an estimated \$56,000-107,000 per patient per year of treatment<sup>24</sup>.
- End-stage renal disease cost the Canadian health-care system an estimated \$1.8 billion in the year<sup>25</sup>.

## Inflammatory Bowel Disease (IBD)

### Prevalence

- Affects 0.7% of Canadians, and is expected to increase to nearly 1% by 2030<sup>26</sup>.
- Canada has among the highest rates of childhood-onset IBD in the world<sup>27</sup>.

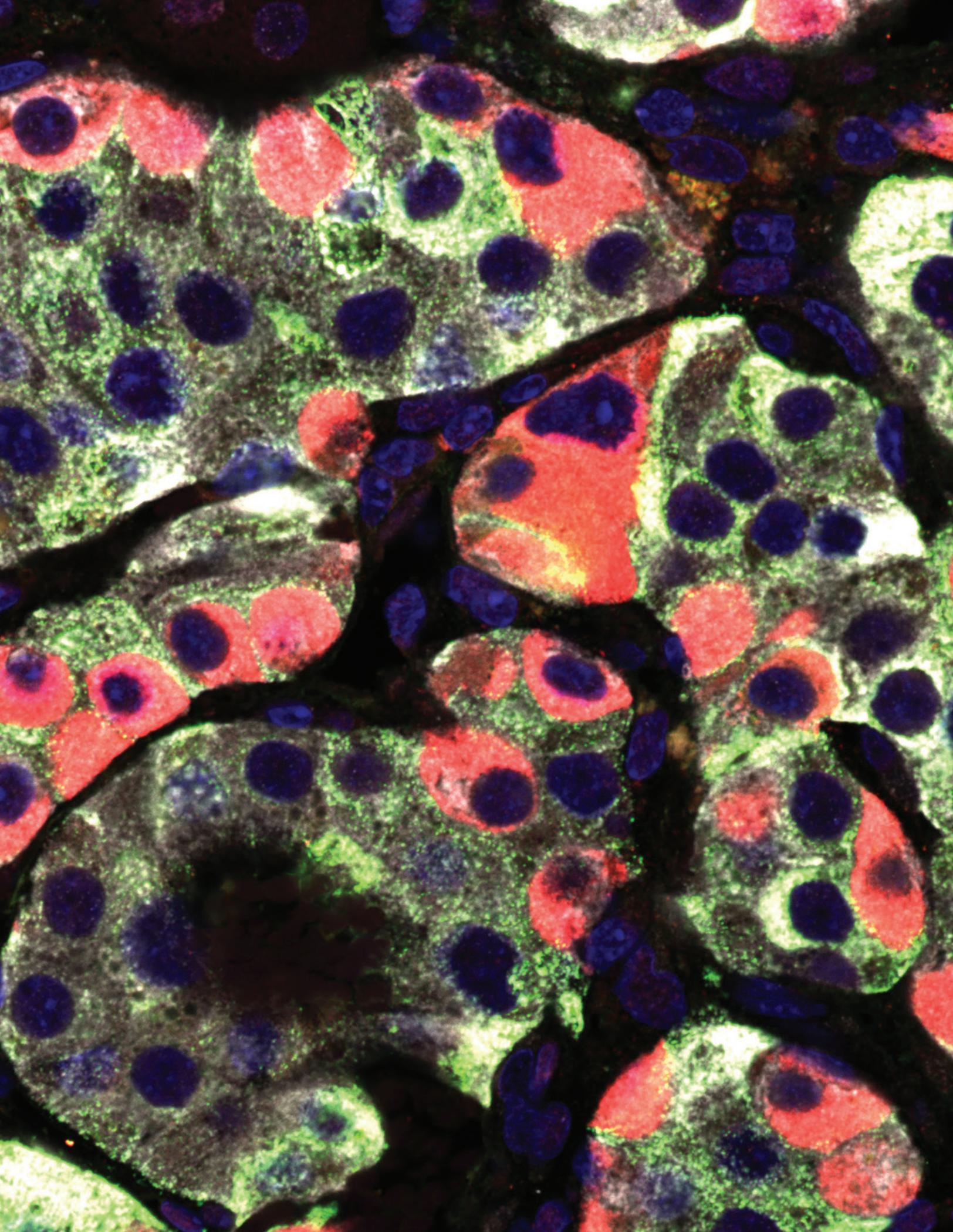
### Health impact<sup>28</sup>

- Severe impact on quality of life due to abdominal pain, severe diarrhea, rectal bleeding, malnutrition and weight loss.
- Increased risk of osteoporosis, liver and eye inflammation, blood clots, arthritis, colorectal cancer, mental illness.

### Cost

- Economic costs estimated at \$2.6 billion in Canada in 2018. Direct medical costs are approximately \$1.28 billion, primarily prescription drugs and hospitalizations<sup>29</sup>.

Human islet graft  
Green: insulin  
Red: glucagon  
Grey: synaptophysin  
Blue: nuclei



**WHERE**  
do we want to go?

The strategic priorities for 2021-26 were developed by the INMD Institute Advisory Board after consultation with researchers, and governmental and voluntary health organization partners recognizing the urgency and heavy burden of diseases and conditions in the INMD mandate (see Snapshot).

**The INMD Strategic Plan for 2021-26 will catalyze world-leading research that promotes optimal and equitable nutrition and metabolic outcomes for Canadians.**

Throughout this document, readers will note references to optimizing *nutrition and metabolic health* as a way to refer to supporting health and preventing or treating diseases within the INMD mandate. The term nutrition and metabolic health recognizes the inter-relationship of the processes involved in ingesting food and dietary components of appropriate quality and quantity, their absorption, metabolism, and excretion. These processes are needed for growth and development, health maintenance, tissue repair, and for the prevention and treatment of diseases that involve kidney, liver, endocrine and digestive systems.

INMD’s new strategic priorities will:

- forge a health research agenda and support capacity building across disciplines, sectors, and regions,
- embrace scientific opportunity and reflect the emerging health needs of Canadians and information needs of health policy decision-makers, and
- facilitate partnerships and accelerate the transfer of new knowledge into benefits for Canadians.

To achieve this expansive vision, INMD will work with stakeholders, including decision-makers and other knowledge users, to make critical investments and catalyze activities that will lead to a better understanding of the basis of human health and disease. These investments and activities will create opportunities for integrated knowledge translation and knowledge mobilization and will accelerate the translation of new knowledge into improved diagnostics, preventative policy and therapeutic interventions for diseases in the INMD mandate area.

CIHR has made a strong commitment to strengthening Indigenous health research in Canada. The Truth and Reconciliation Commission of Canada: Calls to Action<sup>30</sup> recognizes the legacy of residential schools and more broadly, the legacy of colonialism, on the health of Indigenous Peoples, the burden of chronic

disease, and gaps in health outcomes between Indigenous and non-Indigenous communities. INMD’s new strategic priorities will include investment in research that supports the priorities of Indigenous communities and contributes to CIHR’s overall efforts in reducing health inequities.

The INMD Strategic Plan for 2021-2026 will build upon and leverage previous INMD investments and successes, including initiatives in Food and Health; Environments; Genes and Chronic Disease; and Obesity and Healthy Body Weight: Seeking Solutions, as well as key CIHR Initiatives such as Personalized Medicine and the SPOR Networks in Chronic Disease. With this solid foundation, INMD aims to challenge the upward trajectory to reduce the prevalence and impact of nutritional and metabolic diseases, and increase equitable health outcomes in Canada.

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**INMD Vision**

Catalyzing world-leading research that promotes optimal and equitable nutrition and metabolic health outcomes for Canadians

**Strategic Priorities**

INMD will contribute to improving the health and quality of life of Canadians by preventing and reversing the growing burden of INMD-related conditions (i.e., endocrine, liver, digestive, kidney and metabolic disorders); INMD will support research, knowledge mobilization and capacity building to:

- Accelerate Discovery: Identify and intervene in the physiological and molecular mechanisms of nutritional and metabolic health and disease
- Harness Discovery and Diversity: Generate precision prevention, diagnosis and treatment strategies in nutrition and metabolic health
- Pursue Health Equity: Develop preventive strategies through social, environmental and policy interventions that reduce nutritional and metabolic health inequities and improve community and population health
- Support development of Canadian research capacity towards improved nutritional and metabolic health outcomes



# Strategic Priority 1

## Accelerate Discovery: Identify and intervene in the physiological and molecular mechanisms of nutritional and metabolic health and disease

### Specific objectives

- i. Increase the generation and use of data from human studies to identify physiological and molecular mechanisms of nutritional and metabolic health and disease
- ii. Develop translational research models that recapitulate the mechanisms of nutritional and metabolic health and disease in humans
- iii. Increase the discovery, development and evaluation of therapeutic targets and interventions

Numerous technologies have emerged in recent years that have created unprecedented opportunities to understand the biological basis of health and disease. However, the process of translating fundamental discoveries in animal models or tissues to the clinic and population health outcomes is long and expensive. Moreover, validation of pathways and targets in humans is often considered late in the discovery process. To speed the translation of discoveries along the continuum from discovery to health outcomes, INMD will support research that draws upon data from human studies to identify the physiological and molecular mechanisms of health and disease, research that integrates translational and discovery research, and research to assess potential therapeutic targets and interventions for further development.

This strategic priority will build on and expand existing Canadian research strengths in nutrition and metabolic health across the health research continuum with a focus on transcending the translational inertia that lies between basic science and clinical application. Support for interdisciplinary research will harness Canadian capacity for team science, to accelerate the generation of scientific knowledge and the identification and development of therapeutic targets, biomarkers and interventions.

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### Examples of Current Initiatives that Align with Strategic Priority 1

- Programmatic Grants in Environments, Genes and Chronic Disease
- Canadian Microbiome Initiative 2: A Focus on Function and Translation
- *100 Years of Insulin: Accelerating Canadian Discoveries to Defeat Diabetes*
  - Netherlands-Canada Type 2 Diabetes Research Consortium
  - Team Grants in Diabetes Mechanisms and Translational Solutions

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### Potential Actions for Strategic Priority 1

- Support research on physiological and molecular pathways involved in human nutrition and metabolism
- Support translational research to identify and validate pre-clinical targets prioritizing research to identify physiological/ pathophysiological mechanisms in humans, with consideration of disease heterogeneity and dimensions of diversity
- Support translational teams with the breadth and partnerships necessary to transform molecular discoveries into solutions for human health working with industry, professional and patient-based organizations
- Develop approaches to validate pre-clinical targets in human biological materials
- Support clinical research to assess the most promising therapeutic targets and interventions



## Strategic Priority 2

### Harness Discovery and Diversity:

**Generate precision prevention, diagnosis and treatment strategies in nutrition and metabolic health**

#### Specific objective

- i. Develop resources and experimental approaches to better understand and address heterogeneity in disease susceptibility, progression and outcomes

It is increasingly clear that one-size-fits-all approaches to prevention, diagnosis and treatment have limited effectiveness. Differences at the molecular, individual (e.g., sex and gender), and population level contribute to heterogeneity that significantly impacts the effectiveness of interventions, health equity, diagnostic tools and treatment approaches. Heterogeneity must be considered if we are to design improved approaches to prevention, diagnosis and treatment.

Numerous Canadian technological and data resources will facilitate research to address heterogeneity in nutrition and metabolic health and disease. Enhancing interdisciplinary work will be vital to: (1) harmonize and/or augment existing resources, (2) develop new methodologies to help us understand how heterogeneity contributes to nutrition and metabolic health and disease, and (3) develop precision prevention, diagnostic and treatment approaches that can be translated to clinical and public health settings to result in improved health outcomes for all Canadians.

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#### Examples of Current Initiatives that Align with Strategic Priority 2

- Health Challenges in Chronic Inflammation – Phase 2
- Human Immunology Initiative
- Personalized Health
- *100 Years of Insulin: Accelerating Canadian Discoveries to Defeat Diabetes:*
  - UK-Canada Diabetes Research Team Grants
  - Teams Grants in Diabetes Mechanisms and Translational Solutions

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#### Potential Actions for Strategic Priority 2

- Support the development of shared resources (e.g. cohorts, biobanks), including harmonization, enrichment and the development of common technical standards
  - Develop experimental approaches to generate data on disease phenotypes and risk stratification; as well as indicators of disease susceptibility, progression, response to interventions and outcomes in heterogeneous populations
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# Strategic Priority 3

**Pursue Health Equity: Develop preventive strategies through social, environmental and policy interventions that reduce nutritional and metabolic health inequities and improve community and population health**

## Specific objective

- i. Assess the impact of social, environmental, and policy factors, to develop and evaluate interventions to improve nutritional and metabolic health and improve health equity across communities and populations

For many years there has been a recognition that factors beyond individual biological factors and access to health services are important determinants of health and disease. Social and environmental conditions together greatly influence the health of populations and inequities in health and disease burden. It is critical to understand social and environmental factors, including built environment, food security and other factors, that influence health and disease, and to understand how to intervene successfully to effect changes that impact on health. INMD will support innovative social, environmental and policy research that builds on existing knowledge to inform preventive strategies and interventions to improve health status at the individual, community and population levels in relation to nutrition and metabolic health and disease.

This strategic priority will build on existing large datasets and contribute to developing new datasets where needed, and catalyze and develop interdisciplinary and inter-sectoral collaborations to ensure the research questions and approaches are relevant to policy makers.

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## Examples of Current Initiatives that Align with Strategic Priority 3

- Pathways to Health Equity for Aboriginal Peoples
- Food Security and Climate Change in the Canadian North
- Healthy Cities Research Initiative
  - Implementation Science Team Grants
- *100 Years of Insulin: Accelerating Canadian Discoveries to Defeat Diabetes*
  - Team Grants in Diabetes Prevention and Treatment in Indigenous Communities: Resilience and Wellness

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## Potential Actions for Strategic Priority 3

- Support transdisciplinary research that uses emerging/integrated approaches (e.g. big data, AI) and partnerships with policymakers, organizations and communities to create, implement and evaluate social, environmental and policy interventions to improve nutritional and metabolic health
  - Support integration of shared data platforms and research by creating innovative linkages among existing datasets
  - Support Indigenous-led community driven research, leadership and partnerships that address social, environmental and policy factors in health outcomes and inequities using a resilience and wellness approach
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# Strategic Priority 4

## Support development of Canadian research capacity towards improved nutritional and metabolic health outcomes

### Specific objectives

- i. Support the development and sustainability of a community of outstanding researchers relevant to the INMD mandate
- ii. Support the principles of equity, diversity and inclusion in all INMD training and capacity-building initiatives
- iii. Work together with Indigenous communities to build capacity to lead and participate as researchers and partners

Capacity building is about so much more than individual research training. INMD’s Strategic Plan for 2021 – 2026 supports programmatic approaches to build research capacity that will assist researchers in gaining the skills and experience that will create the research leaders of tomorrow. INMD recognizes the need to integrate the principles of equity, diversity and inclusion. In addition, INMD will work together with Indigenous communities, the CIHR Institute of Indigenous Peoples’ Health (IIPH), and CIHR’s Indigenous health research unit to build capacity to lead and participate as researchers and partners.

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### Examples of Current Initiatives that Align with Strategic Priority 4

- Health Research Training Platform Pilot
- Network Environments in Indigenous Health Research
- INMD Early Career Investigator Meetings
- Sex and Gender Science Chair in Diabetes
- Strategy for Patient-Oriented Research (SPOR)

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### Potential Actions for Strategic Priority 4

- Support targeted capacity building initiatives, such as training programs, to address needs for researchers at multiple career stages with specific expertise and experience
- Support and facilitate the creation of transdisciplinary research including relevant partnerships with community, patient, government, healthcare, charity and industry
- Help INMD-supported teams learn and share team science best-practices (e.g. team building/maintenance, shared leadership, transdisciplinary collaboration, effective partnering)
- Through INMD investments and activities, address barriers and provide support for:
  - Equitable and inclusive access to funding opportunities and participation in the research system
  - Data and analyses for decision-making informed by equity, diversity and inclusion
  - Capacity building in the INMD mandate within Indigenous communities consistent with the strategies outlined in *A Vision for a Healthier Future*, CIHR’s Strategic Plan 2021-2031 and the priorities of the CIHR Institute of Indigenous Peoples’ Health (IIPH)

**HOW**  
will we get there?



INMD will contribute to improving the health and quality of life of Canadians by preventing and reversing the growing burden of INMD-related conditions (i.e., endocrine, liver, digestive, kidney, nutritional and metabolic disorders). From 2021-26, INMD commits to playing a leading role as a convenor, thought-leader,

and partner engaged with our investigator and clinical communities, patients, knowledge users, health charities, and policy-makers to support research, knowledge mobilization and capacity building aimed at addressing the following strategic priorities:

## 1. Accelerate Discovery: Identify and intervene in the physiological and molecular mechanisms of nutritional and metabolic health and disease

Specific Objectives	Emerging and Potential Actions	Short-term Indicators	Long-term Outcomes
i. Increase the generation and use of data from human studies to identify physiological and molecular mechanisms of nutritional and metabolic health and disease	<p>Support research on physiological and molecular pathways that regulate human nutrition and metabolism:</p> <ul style="list-style-type: none"> <li>• Develop new experimental approaches using emerging and/or integrated technologies (e.g. enhanced imaging methods, omics, AI)</li> <li>• Support team-based interdisciplinary approaches that bridge scientific disciplines and foster collaboration</li> </ul>	<p>INMD-supported researchers:</p> <ul style="list-style-type: none"> <li>• Identify potential therapeutic targets and intervention strategies to support human health and treat nutritional and metabolic disease</li> <li>• Develop novel or improved methods using emerging/integrated technologies to study nutritional and metabolic health and disease in humans</li> </ul>	<ul style="list-style-type: none"> <li>• More effective therapeutic and intervention strategies based on better understanding of underlying mechanisms of human nutritional and metabolic health and disease</li> </ul>
ii. Develop translational research models that recapitulate the mechanisms of nutritional and metabolic health and disease in human	<p>Support translational research to identify physiological/ pathophysiological mechanisms in humans:</p> <ul style="list-style-type: none"> <li>• Develop approaches to validate pre-clinical targets in human biological materials</li> <li>• Develop experimental models that recapitulate human physiology/ pathophysiology with consideration of disease heterogeneity and dimensions of diversity</li> </ul>	<p>INMD-supported researchers:</p> <ul style="list-style-type: none"> <li>• Identify physiological/ pathophysiological mechanisms in humans</li> <li>• Identify and validate potential therapeutic targets or biomarkers</li> <li>• Identify translational pre-clinical models</li> <li>• Increase understanding of differences in physiological and molecular mechanisms associated with nutritional and metabolic health outcomes</li> </ul>	<ul style="list-style-type: none"> <li>• Increased understanding of human physiology and pathophysiology</li> <li>• Development of translational models that recapitulate human physiology/ pathophysiology</li> <li>• Therapeutic targets and/or interventions for nutritional and metabolic health and disease in humans with consideration of disease heterogeneity and dimensions of diversity</li> </ul>
iii. Increase the discovery, development and evaluation of therapeutic targets and interventions	<ul style="list-style-type: none"> <li>• Support translational teams with the breadth and partnerships necessary to transform molecular discoveries into solutions for human health working with industry, professional and patient-based organizations</li> <li>• Develop approaches to validate pre-clinical targets in human biological materials</li> <li>• Support clinical research to assess the most promising therapeutic targets and interventions</li> </ul>	<p>INMD-supported researchers:</p> <ul style="list-style-type: none"> <li>• Build capacity and partnerships with necessary breadth for clinical translation</li> <li>• Move discovery research into clinical testing phase</li> <li>• Share early findings such as proof-of-concept for therapeutic approaches; evaluation of interventions</li> </ul>	<ul style="list-style-type: none"> <li>• New evidence-based therapeutic approaches and interventions to reduce the burden of INMD-related conditions</li> </ul>

## 2. Harness Discovery and Diversity: Generate precision prevention, diagnosis and treatment strategies in nutrition and metabolic health

### Specific Objectives

- i. Develop resources and experimental approaches to better understand and address heterogeneity in disease susceptibility, progression and outcomes

### Emerging and Potential Actions

Support the development of shared resources (e.g. cohorts, biobanks), including harmonization, enrichment and the development and implementation of common technical and ethical standards, as appropriate.

Develop experimental approaches to generate data on:

- Disease phenotypes and risk stratification with the aim of identifying the mechanisms of disease in heterogeneous populations with consideration of sex/gender, age, ethnicity
- Novel and improved indicators of disease susceptibility, progression, response to interventions and outcomes in heterogeneous populations

### Short-term Indicators

INMD-supported researchers:

- Use novel data integration approaches to generate outcomes data more efficiently and effectively
- Establish technical Standard Operating Procedures (SOP) and standardized patient data (e.g. clinical, nutritional) and bio-banked samples within clinical trials to maximize the results/data from these cohorts
- Improve understanding of the effectiveness of diagnostics and therapeutics in individuals or specific populations (e.g. pharmacogenomics) and apply to clinical settings
- Increasing access to publicly available big datasets

### Long-term Outcomes

- The dimensions of human diversity are integrated into the development and application of novel diagnostics and therapeutics to provide targeted health strategies and interventions for individuals and specific populations
- Validated diagnostic, prognostic, predictive and surrogate bio- and other markers of outcomes for Health Canada, U.S. Food and Drug Administration
- Greater rate of development of commercialized and patented biomarkers, molecules and related technologies

### 3. Pursue Health Equity: Develop preventive strategies through social, environmental and policy interventions that reduce nutritional and metabolic health inequities and improve community and population health

#### Specific Objectives

i. Assess the impact of social, environmental, and policy factors, to develop and evaluate interventions to improve nutritional and metabolic health and reduce inequities across communities and populations

#### Emerging and Potential Actions

Support transdisciplinary research that uses emerging/ integrated approaches (e.g. big data, AI) and partnerships with policymakers, organizations and communities to create, implement and evaluate social, environmental and policy interventions to improve nutritional and metabolic health

Support integration of shared data platforms and research by creating innovative linkages among existing and novel datasets (e.g. geo-spatial, environmental, nutritional, behavioural, health, genomics, and biomarker datasets)

Support Indigenous-led community driven research, leadership and partnerships that address social, environmental and policy factors in health outcomes and inequities based on a resilience and wellness approach

#### Short-term Indicators

INMD-supported transdisciplinary teams and partnerships with diverse members, leaders and partners, including Indigenous community leadership, engagement and knowledge base

- Generate new knowledge regarding how social, environmental, and policy factors affect nutritional and metabolic health and inequities
- Develop and test tools to aid the implementation of evidence-based policy and practice
- Develop, implement and evaluate promising social, environmental and policy interventions to improve nutritional and metabolic health and reduce inequities across communities and populations

#### Long-term Outcomes

- Policy makers seek and obtain the information they need to make informed decisions about the nutritional and metabolic health impacts and financial costs of potential interventions
- Evidence-based social, environmental and policy interventions are increasingly implemented across Canada, resulting in improved nutritional and metabolic health, reduced inequities among groups, and reduced burden of poor health
- Equitable nutritional and metabolic health outcomes for Indigenous communities

## 4. Support development of Canadian research capacity towards improved nutritional and metabolic health outcomes

Specific Objectives	Emerging and Potential Actions	Short-term Indicators	Long-term Outcomes
i. Support the development and sustainability of a community of outstanding researchers relevant to the INMD mandate	<p>Support and facilitate:</p> <ul style="list-style-type: none"> <li>targeted capacity building initiatives such as training programs, to address needs for researchers with specific expertise and experience</li> <li>the creation of transdisciplinary research including relevant partnerships with community, patient, government, healthcare, charity and industry</li> <li>INMD-supported teams learn and share team science best-practices (e.g. team building/maintenance, shared leadership, transdisciplinary collaboration, effective partnering)</li> </ul>	<p>INMD-supported researchers, teams, partnerships and networks:</p> <ul style="list-style-type: none"> <li>Have the individual and collective skills and diverse expertise and leadership to achieve INMD goals, and work together cohesively</li> <li>Increasingly integrate disciplines, including knowledge users, and demonstrate effective collaboration</li> <li>Demonstrate an inclusive view of research excellence in their structure and functioning</li> <li>Have the range and strength of partnerships and collaborations needed to effectively pursue translational goals</li> </ul>	<ul style="list-style-type: none"> <li>Teams successfully answer complex research questions and transform discoveries effectively into better and more equitable health outcomes</li> <li>Sustainable community of INMD researchers</li> </ul>
ii. Support the principles of equity, diversity and inclusion in all INMD training and capacity-building initiatives	<p>Through INMD investments and activities, address barriers, and provide support for:</p> <ul style="list-style-type: none"> <li>Equitable and inclusive access to funding opportunities and participation in the research system</li> <li>Data and analyses for decision-making informed by equity, diversity and inclusion</li> </ul>	<p>INMD-supported researchers, teams, partnerships and networks:</p> <ul style="list-style-type: none"> <li>Demonstrate increasingly diverse participants</li> <li>Incorporate equity, diversity and inclusion considerations in research questions and design</li> </ul>	<ul style="list-style-type: none"> <li>Greater equity, diversity and inclusion in the INMD research community improves the quality, social relevance and impact of its research</li> </ul>
iii. Work together with Indigenous communities to build capacity to lead and participate as researchers and partners	<p>Through INMD investments and activities, address barriers, and provide support for capacity building in the INMD mandate within Indigenous communities consistent with the priorities of the CIHR Institute of Indigenous Peoples' Health (IIPH)</p>	<p>INMD-supported researchers, teams, partnerships and networks demonstrate increased capacity in the INMD mandate within Indigenous communities</p>	<ul style="list-style-type: none"> <li>Research addressing the priorities of Indigenous communities that supports improved and equitable nutritional and metabolic health outcomes</li> </ul>



**HOW**  
will we know  
we have arrived?



INMD is committed to evaluating the outputs and outcomes of the research activities undertaken during the time period covered by this INMD strategic plan. CIHR has developed a robust approach to monitoring and evaluation, which includes a plan for regular assessment of institute performance, similar to the evaluation of INMD undertaken in 2017. Assessing scientific impact is inherently complex and multi-dimensional and for this reason, a multi-dimensional approach needs to be used that incorporates both qualitative and quantitative measures, including bibliometrics, surveys, and data analyses.

In the absence of implementation details, yet to be established for many of the new INMD strategic priorities described above, it is not possible to provide performance measurement indicators. In contrast, INMD has developed potential indicators of performance measurement for the INMD-led, multi-institute, multi-component initiative, *100 Years of Insulin: Accelerating Canadian Discoveries to Defeat Diabetes*, which is currently being implemented. See Appendix B for details.

## Appendix A

### INMD Strategic Planning Process

INMD developed this strategic plan through an iterative development process with the INMD Institute Advisory Board (IAB) to select and validate priorities using a consensus approach and based on input received from the INMD research community and partners.

The development of the new INMD Strategic Plan began with the appointment of Dr. Norman Rosenblum in January 2018, and an INMD Institute Advisory Board meeting held in Toronto in April 2018. At this first IAB meeting, IAB members were asked to review the INMD Institute Evaluation that was completed in May 2017. The Report of the INMD Evaluation Panel is available on the [INMD web site](#) and was circulated in the meeting materials sent in advance of the IAB meeting, along with the previous version of the INMD Strategic Plan. IAB members were also asked to consider materials pertaining to the context of the development of the INMD Strategic Plan, and various approaches to Strategic Planning. At this point, the IAB divided into two working groups: Group 1 was tasked with stakeholder outreach, which involved speaking with key stakeholder groups, health charities, community/society members, to request their strategic plans and priorities and to advise INMD staff on the development of a stakeholder survey and Group 2 was tasked with looking at INMD-relevant funding data, which included the identification of data gaps.

In May 2018, INMD sent a survey to its partners (health charities, community/society members) to seek input into the development of the new INMD strategic plan. These stakeholders were requested to complete the survey on behalf of their organization and to seek input from their constituency (e.g., Scientific Advisory Committee, Board of Directors, membership including patients/patient partners), so that the response reflected the views of their respective organization. Responses from 11 organizations were received by September 2018. This input was considered and discussed by the INMD IAB, along with the funding data, at the November 2018 meeting held in Winnipeg. At this meeting, the IAB recommended that INMD survey researchers directly and IAB members offered to screen through the responses for themes and new ideas. This survey was promoted through the INMD newsletter in December 2018, with responses due by end of January 2019. A total of 68 responses were received. In addition, it was suggested that INMD engage with relevant Government stakeholders to seek input including Health Canada, Public Health Agency of Canada, and Agriculture and Agri-Food Canada, as well as provincial health research funders through the National Alliance of Provincial Health Research Organizations (NAPHRO). The INMD Scientific Director met with representatives from all of these organizations to seek input.

In February 2019, the INMD met in Toronto for a one-day special meeting focused on the development of the Strategic Plan. At this meeting, the IAB discussed the core values or principles for consideration in the context of the new INMD Strategic Plan. These principles included:

- Inclusivity, recognizing the broad mandate of INMD
- Integration of systems and areas of the INMD mandate
- Equity, diversity and inclusion, given the burden of diseases in INMD mandate areas is not equally distributed in the Canadian population
- Support the priorities of Indigenous communities and contribute to CIHR's overall efforts in reducing health inequities in First Nations, Metis and Inuit communities
- Capacity-building as a fundamental element of the Strategic Plan
- Striving for the impact of strategic research and related activities contributes to CIHR's overall mandate of improving the health of Canadians and the Canadian health care systems

At this February meeting, the IAB broke into small groups to try to identify common themes that emerged from the stakeholder input collected. A number of groupings or themes began to emerge, with a focus on nutrition and metabolism, and prevention, reversal and reduction of chronic diseases in the INMD mandate by prioritizing:

1. Novel mechanisms and approaches to chronic disease progression and reversal
2. Innovative social, environmental and policy solutions to disease prevention and treatment
3. Heterogeneity – mechanisms, biomarkers, moving towards precision-based approaches to address heterogeneity in disease susceptibility, treatment and outcomes (across pillars)

These themes required further development given the identification of divergent topics and resources that needed to be considered in formulating a final set of priorities. Accordingly, in October 2019, the IAB met in Edmonton to further develop these themes and corresponding objectives and performance measures. These discussions were facilitated by an independent external facilitator, Michelle Campbell, who helped prompt the IAB to work through this process, and assisted INMD in producing an initial draft of the INMD Strategic Plan after the meeting.

Unfortunately the INMD IAB was forced to cancel face-to-face meetings during 2020 as a result of the COVID-19 pandemic; however, work continued on the draft version of the INMD Strategic Plan by INMD staff, and the IAB were asked to provide input and comments on these drafts. In November 2020, the INMD IAB met virtually and approved the final draft version of the INMD Strategic Plan prior to INMD staff submitting it for approval within CIHR.

## Appendix B

### Performance Measurement Indicators for *100 Years of Insulin: Accelerating Canadian Discoveries to Defeat Diabetes*

#### ***100 Years of Insulin: Accelerating Canadian Discoveries to Defeat Diabetes***

Goal: to develop new preventive and therapeutic paradigms that reverse the upward trajectory of diabetes prevalence and associated morbidities, and reduce the impact of diabetes on individuals, families and communities.

The objectives of this initiative are:

1. To elucidate previously undefined mechanisms that control the onset and progression of all types of diabetes mellitus and related complications.
2. To develop translational solutions aimed at prevention, treatment, and delivery of care for people living with diabetes to:
  - a. Accelerate stem cell research aimed at physiological insulin replacement for people with type 1 diabetes.
  - b. Develop new therapeutic strategies aimed at metabolic reset and reversal of type 2 diabetes.
  - c. Develop and implement effective models of care delivery aimed at improving diabetes care and patient outcomes.
3. To define and integrate models of resilience and wellness into diabetes prevention and treatment approaches among First Nations, Inuit and Métis Peoples that are Indigenous-led and community-driven to reverse the upward trajectory of diabetes in these communities.

## Potential performance measurement indicators for the initiative, *100 Years of Insulin: Accelerating Canadian Discoveries to Defeat Diabetes.*

Category	Description	Potential indicators
Advancing knowledge	discoveries/breakthroughs, contributions to the scientific literature (grey or peer-reviewed) and may include measures of research quality, activity, outreach and structure	<ul style="list-style-type: none"> <li>• reports/publications on new diabetes mechanisms that control onset or progression of diabetes and related complications</li> <li>• reports/publications on validated targets or models that are moving along the translational continuum</li> <li>• # of human studies and trials that have advanced along the translational continuum towards physiological insulin replacement</li> <li>• proportion of funded grantees reporting new translational solutions or interventions aimed at diabetes prevention, reversal of type 2 diabetes, diabetes treatment or delivery of care</li> <li>• bibliometric measures of research output and impact</li> </ul>
Building capacity	the development and enhancement of research skills in individuals and teams, additional research-activity funding (e.g., funding partnerships) as well as the development/enhancement of platforms	<ul style="list-style-type: none"> <li>• # trainees supported through funded diabetes grants</li> <li>• # of new platforms developed/ reported to support diabetes research in Canada</li> <li>• co-author analysis</li> </ul>
Informing decision-making	includes the impacts of health research in the areas of health related decision-making (i.e., science/research, general public, clinical and managerial decision-making, practice and policy and health products decision making)	<ul style="list-style-type: none"> <li>• # citations by other authors, both from Canada and from other countries</li> <li>• health research specialization index</li> <li>• % grantees reporting having an impact on stakeholders through policy and practice guidelines</li> </ul>
Health and Health System impacts	<p>advances in the prevention, diagnosis, treatment and palliation as well as changing health status and determinants of health.</p> <p>also includes advances and efficiencies in the way the health system functions</p>	<ul style="list-style-type: none"> <li>• reports/publications on impact of research findings on health care and the health care system, for example, through diabetes clinical practice guidelines</li> <li>• reports/publications on improved models of diabetes prevention and treatment approaches among First Nations, Inuit and Métis Peoples that are Indigenous-led and community-driven</li> </ul>
Broad economic and social impacts	commercialization of research discoveries, human capital gains, health benefits (specific costs of implementing research findings in the broad health system), well-being and social benefit indicators	<ul style="list-style-type: none"> <li>• # patents generated from funded diabetes research, regulatory approvals sought</li> </ul>

## Appendix C

### INMD Institute Advisory Board



**Christopher Kennedy  
(Chair)**

Senior Scientist, Ottawa Hospital Research Institute & Kidney Research Centre  
Professor, Departments of Medicine & Cellular and Molecular Medicine  
University of Ottawa



**Elisabeth Fowler**

Chief Executive Officer  
Canadian Ophthalmological Society  
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**Catherine Field  
(Vice Chair)**

Professor, Department of Agricultural, Food and Nutritional Science  
University of Alberta



**Julie Ho**

Associate Professor, Departments of Internal Medicine & Immunology  
University of Manitoba



**Stephanie Atkinson  
(Former Chair)**

Professor, Department of Pediatrics  
McMaster University



**Stephen James**

Director, Division of Digestive Diseases and Nutrition  
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National Institute of Diabetes and Digestive and Kidney Diseases



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**Sukhinder Cheema**

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**Wally MacNaughton**

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## Appendix D

### INMD Staff



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Senior Medical Advisor, Statistics Canada  
Professor, Department of Family Medicine  
and School of Epidemiology and Public  
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Core Senior Scientist, Institute for Clinical  
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#### **Norman Rosenblum** MD, FRCPC, FCAHS

Scientific Director



#### **Marc Prentki**

Professor, Department of Nutrition  
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Director, Montreal Diabetes  
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#### **Mary-Jo Makarchuk** MSc, MHSc, RD

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#### **Erica Samms-Hurley**

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#### **Keeley Rose** MSc, PhD

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#### **George Tolomiczenko**

Executive Director  
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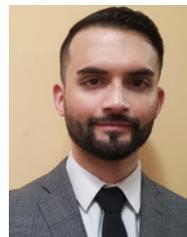
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