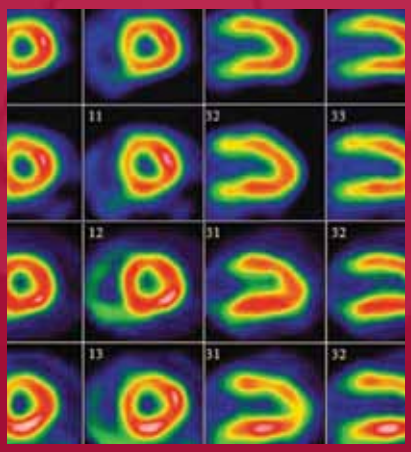
UNIVERSITY OF OTTAWA
HEART INSTITUTE

INSTITUT DE CARDIOLOGIE
DE L'UNIVERSITÉ D'OTTAWA

Ottawa Region for Advanced Cardiovascular Research Excellence (ORACLE)

STRATEGIC PLAN: 2013–2017






WE DO EXTRAORDINARY THINGS
EXTRAORDINARILY WELL

NOUS FAISONS DES CHOSES EXTRAORDINAIRES,
EXTRAORDINAIREMENT BIEN

The University of Ottawa Heart Institute is Canada's largest and foremost cardiovascular health centre dedicated to understanding, treating and preventing heart disease. We deliver high-tech care with a personal touch, shape the way cardiovascular medicine is practiced, and revolutionize cardiac treatment and understanding. We build knowledge through research and translate discoveries into advanced care. We serve the local, national and international community, and are pioneering a new era in heart health.

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EXECUTIVE SUMMARY

The vision for this five-year strategic plan is that the University of Ottawa Heart Institute (UOHI) and regional partners will be key Canadian leaders in cardiovascular innovation and knowledge translation. This will put the Ottawa region well on the road to be recognised as amongst the top international central hubs in cutting-edge cardiovascular research and knowledge implementation in ten years.

Four research priority themes were identified following extensive consultations:

Personal Tailored Health Solutions: Building on the strengths of the Ottawa region in genetics and systems biology, the plan aims to identify and validate novel biomarkers to predict and personalize treatment for common cardiovascular conditions such as coronary disease, heart failure, cardiac rhythm disturbances, and valvular disease. We will also enhance our advanced heart imaging capabilities to fully characterize early disease processes. We will develop easy-to-use tools and models to help patients at the bedside.

Unlocking Novel Causes of Cardiovascular Disease: It has become clear that the traditional risk factors are no longer adequate for us to prevent and ultimately eliminate heart disease. We need to understand new pathways leading to disease by unlocking the function of the new markers and pathways from systems biology. We will also examine tissues from patients using novel tools and, in particular, reprogrammed stem cells from patients with known cardiovascular diseases. We will track these processes in patients using advanced imaging tools and test novel treatments.

Optimizing the Technology and Human Interface in Heart and Blood Vessels: Building on our long-standing strength in biomedical devices and regional leadership in communications technology and photonics, we will develop novel tools for diagnostics as well as new devices for treatment. In addition, we will integrate telemedicine and information technology to enhance patients' participation as partners in care. We will accelerate our regenerative medicine program and commercialize our discoveries.

Community Intervention, Health Systems and Health Policy Innovations in Cardiovascular Health: Building on our model of Champlain community prevention programs, we will expand to chronic disease management and test novel health delivery programs, including Northern Canadian regions. We will build expertise in health policy research and partner with governments across Canada to build on our experience in leading programs such as the national C-CHANGE initiative.

People & Expertise

- We will create "Innovation Clusters" of diverse expertise to enhance collaboration and exchange. These will later develop into Centres of Excellence to deliver on the four research priority themes.
- We will develop and/or recruit key leading investigators to drive innovation forward.
- We will enable the means to efficiently access state-of-the-art infrastructure to accelerate data acquisition and analysis.

Six Enabling Platforms will be formed to deliver on the priorities themes. These are:

1. Regional Human Ethics Review Board (HREB)
2. Functional Linkages of Clinical Databases
3. Biobank of Blood and Tissues, and Associated Clinical Databases
4. Effective Clinical Methods and Informatic Support
5. Molecular and Multi-Modality Imaging
6. Regional Cardiovascular Training Program and Training Support

Disease areas for Priority Considerations are:

1. Heart Failure
2. Arrhythmias - Atrial Fibrillation
3. Vascular/Cardiometabolic Diseases
4. Valvular Diseases

VISION

In five years, the University of Ottawa Heart Institute and regional partners will be key Canadian leaders in cardiovascular innovation and knowledge translation.

In 10 years, the Ottawa Region for Advanced Cardiovascular Research Excellence will be recognised as amongst the top international central hubs in cutting-edge cardiovascular research and knowledge implementation.

MESSAGE

FROM THE SCIENTIFIC DIRECTOR, UNIVERSITY OF OTTAWA HEART INSTITUTE

We have arrived at an extraordinary time juncture in Ottawa for cardiovascular research. The University of Ottawa Heart Institute (UOHI) and regional partners are poised to catalyse cardiovascular research with purpose and momentum. With its exemplary clinical leadership, talented and dedicated research community, excellent infrastructure and a supportive patient community, Ottawa is ready for arrival at the next level of research excellence and global impact. To achieve this, we will need to create "Innovation Clusters" to foster collaboration, break down silos, leverage Ottawa's unique regional advantage, generate lateral connectivity to harness talent, expertise, resources and opportunities. In turn, Ottawa will help to define the next cutting edge, and transform into a magnet for the global talent of trainees, rising research stars, and established investigators. It will also form the foundation for a knowledge based economy, centre for a regional hub and the master node for national and international networks.

What we will do: Building on the existing solid foundation of research dedication and excellence, we will achieve our vision by building regional cutting-edge research teams to address the key knowledge gaps that have been identified through numerous consultations throughout this strategic planning process. The strategic research areas will include new tailored, patient-centred approaches to diagnostic and therapeutic strategies, a re-examination of the fundamental causes of cardiovascular disease, novel technologies to improve patient care, and community interventions, health systems and health policy innovations.

How we will do it: The "Innovation Clusters" will consist of dedicated teams of scientists, clinicians, students and trainees working together to achieve a common vision that harnesses multi-disciplinary expertise from different sectors in the Ottawa region, complemented by strategic recruitment of new talents. The cluster scientists will collaborate to test transformative ideas, using optimally managed, state-of-the-art infrastructure. In a challenging economic environment, we will leverage our resources through strategic harmonisation of our support infrastructure. We will strive for the most efficient solutions, and we will ensure that every grant application submitted from the Innovation Clusters has maximum chance for success. We will also partner with the private sector, locally and globally, and we will engage and connect with our patient community and the public through close ties with the UOHI Foundation.

We will be realistic in terms of the timeframe for our achievements. We will move quickly and nimbly yet with enough thought and reserve to ensure that we do things right the first time.

What we will achieve: We will achieve complete integration and synergy between our clinical leadership, our large patient population base, and research innovation and excellence. Capitalising on our unique advantages, the research findings and innovations will achieve international recognition and will be replicated and followed as the gold standard. We will engage knowledge users early in the research cycle allowing us to proactively catalyse the knowledge-based transformation of health delivery. We will ensure complete alignment of our translational research with the clinical need. Ultimately, the outcomes from this strategic plan will benefit citizens and patients of Ottawa, the Champlain region, provinces and territories of Canada, and citizens of countries across the globe.

Together, through "doing extraordinary things extraordinarily well" we can all make the difference that is required to conquer cardiovascular disease.

Peter Liu, MD, FRCPC

MESSAGE

FROM THE VP RESEARCH, UNIVERSITY OF OTTAWA

Having recognized the importance of research into cardiovascular disease and aiming to build on existing excellence, the University of Ottawa has placed cardiovascular research as one of our flagship priorities in the Health sector. The research strategic planning activities currently catalysed at UOHI are therefore very timely and we welcome and strongly support the planning for an internationally recognised hub in cardiovascular research excellence in the Ottawa region.

At the University of Ottawa, we are proud to have very high caliber scientists that study cardiovascular disease and other areas with relevance to cardiovascular health. In addition to the extensive number of researchers at UOHI, there are other exemplary University of Ottawa scientists engaged in the study of cardiovascular disease outside of UOHI. They include Drs. Duncan Stewart and David Courtman based at OHRI, Dr. Phil Wells at The Ottawa Hospital, Drs. Zemin Yao, Mary Ellen Harper as well as my own research program based at the Faculty of Medicine campus. Further, we have a number of basic scientists publishing research of the highest calibre in areas that are key to modern cardiovascular research or that directly impact heart disease. This includes, but is not limited to, research on stem cells, micro RNAs, apoptosis, mitochondrial biogenesis and gut inflammation. In addition, we house world-class centres such as the Heart Foundation Center for Stroke recovery, the Brain and Mind Research Institute, the Stem Cell Network, and the Canadian Stroke Network. We know that for research excellence and for the biggest breakthroughs, research needs to be collaborative and multi-disciplinary. The age of working in silos and single authored publications is long gone and Dr. Liu and I are fully conscious that the goals of this strategic plan will only work if the whole Ottawa region and in particular the large network of the University of Ottawa health partners work collaboratively together. This high level of collaboration is what we strive for at the University of Ottawa. Although we have very good collaborative activities already, there is room for further improvement.

I cannot emphasise enough the importance of working together to maximize the efficient use of resources and to capitalise on our multidisciplinary expertise. Always mindful of the patient community that we will ultimately serve, we need to put together the foundations and infrastructure to meet the goals of this strategic plan, and then, on a continual basis, assess and improve on the model to ensure deliverance of these goals.

This is a wonderful time for cardiovascular research in Ottawa and I applaud Dr. Liu for his leadership in forging an ambitious vision for cardiovascular research and for bringing together the immense talent we have. This will ensure that Ottawa takes a greater place on the world map as a leading edge hub for innovation in cardiovascular research and care for many years to come.

Mona Nemer, Q.C., Ph.D., FRSC

BACKGROUND TO THE STRATEGIC PLANNING PROCESS

The University of Ottawa Heart Institute (UOHI) is already a major contributor to the knowledge base and practice of cardiovascular medicine in many disciplines ranging across bench science and clinical research. Just a few noteworthy examples include:

- Discovering the strongest genetic risk factor for coronary artery disease and heart attack known to date—the 9p21 gene variant
- Pioneering a minimally invasive surgical technique for cardiac bypass
- Altering the standard of care for heart failure with the RAFT trial
- Advancing knowledge and practice in cardiac PET, CT and isotope development
- Discovering a new cellular mechanism for removing cholesterol

Dr. Robert Roberts
President and CEO,
University of Ottawa Heart Institute

The current Research Strategic Plan follows from an earlier strategic plan for UOHI led by our CEO, Dr. Robert Roberts, for the timelines of 2009-2015. The priorities included:

1. Providing our patients with the best, most advanced care possible
2. Shaping and influencing the cardiovascular care, education and research landscape in Canada
3. Attracting the best and brightest medical and scientific professionals
4. Cultivating our international research reputation, particularly in terms of genetics and personalized medicine

UOHI 2009-2015 Strategic Plan for Clinical Care, Education and Research

That strategic plan, currently being delivered upon, has allowed UOHI to remain "the foremost cardiovascular health centre in Canada while fostering our emergence as one of the most advanced heart centres to be found anywhere in the world". Some examples of key deliverables from this plan include the development of sustainable research endowments through partnership with the UOHI Foundation, the establishment of a cardiovascular genetics centre and an enhancement of existing strengths. To ensure that the UOHI's dedication to research excellence has met its goals, the Institute conducted an international external scientific review in 2010, from which many excellent recommendations came forward. The Institute has been working tirelessly to meet these recommendations. Among them was (1) to recruit a senior position of VP Research to improve integration,

communication, and prioritization; (2) to work with research leaders to develop areas of excellence; (3) to foster more cross-disciplinary collaboration; and to (4) focus recruitment to improve depth of expertise and planning for the future.

As a result, Dr. Peter Liu was recruited as Scientific Director in July 2012, fulfilling one of the recommendations of the external scientific review. This, together with the other recommendations from the review and the steady progress the Institute had made in implementing the 2009-2015 strategic plan goals, formed the catalyst for research-specific strategic planning at UOHI.

Excitingly, in 2012, the UOHI research program received widespread recognition when the SCIMAGO Institutions Rankings placed the Institute 57th out of 3,042 research institutions, a ranking which places UOHI within the top 2% of all organizations that conduct research worldwide. As a cardiac centre, the Institute ranked #2 in the world.

Recognizing the strengths in the Ottawa region that extend far beyond the walls of UOHI and understanding the fundamental importance of multi-disciplinary and synergistic collaboration, an Ottawa Region for Advanced CardiovascuLar Research Excellence (ORACLE) is envisioned to be a tangible outcome of this research strategic plan. To this end, stakeholder engagements have been inclusive of the entire Ottawa region, including the University of Ottawa Faculty of Medicine, and The Ottawa Hospital and its partners. High priority has been given to building bridges amongst institutes, partners and disciplines, to creating synergies, teams and efficiencies.

The strategic planning and implementation process is governed and advised by the Strategic Planning Executive Committee and the Steering Committee, which have incorporated Ottawa-wide representation (see Appendix A). The process began with an initial framework developed by Dr. Liu, which was approved by the UOHI Research Corporation's Board of Directors in June 2012. This was followed by a series of informal Think Tank sessions on key topics with representation from all appropriate stakeholders and, finally, culminated in the Cardiovascular Research Strategic Planning Retreat which was held on Sept 29th, 2012.

Framework

As a first step in the strategic planning process, Dr. Liu and his team generated an initial framework for the plan.

Excerpts from the Initial Framework for Strategic Planning, June 2012:

OTTAWA REGION CARDIOVASCULAR RESEARCH STRATEGIC PLAN FRAMEWORK HIGHLIGHTS

The strategic plan in principle will:

Be stakeholder and investigator driven, multi-disciplinary and multi-sited, to engage and advance the Ottawa region cardiovascular community to be the *leading cardiovascular innovation centre in Canada.*

Be built on a bold vision, energizing to the participants, incorporating out-of-the-box thinking and maximizing the Ottawa community's strategic advantage and unique strengths.

Substantively address any remaining recognized deficiencies from the external review, and other key barriers to success.

Take into account environmental factors including new opportunities of funding, advances in science, evolution in patient epidemiology and changes in health systems and practices.

Engage key stakeholders and their leadership in the process – our university, hospital, governmental sectors, allied health disciplines, NGO's, professional organizations, the private sector, UOHI Foundation, knowledge users and the patient community.

Take into account that research leadership now incorporates both excellence in "translational research" and also the "knowledge translation" process to achieve impact on patient care and health outcomes.

The process will invite innovative ideas and strategic suggestions from all sectors first, and then sift, organize, evaluate and prioritize according to the degree of innovation, potential impact, strategic alignment and feasibility.

Implementation of the strategic plan will be realistic, stepwise, nimble and accompanied by relevant milestones, appropriate outcome indicators and required human and infrastructure resource support.

We will develop an objective baseline and on-going benchmarking to evaluate the quality and impact of our research.

Think Tank Sessions and General Recommendations

From July to September 2012, six Think Tank sessions were held to broadly capture the many and varied research pursuits at UOHI and within the Ottawa Region relevant to cardiovascular disease prevention, treatment and care. Topic areas for the Think Tank sessions were identified by the Executive Committee and vetted by the Steering Committee.

Think Tank Session Topics

Topics	Date held	Chair(s)
1. **Heart Failure & Cardiac Regeneration**	July 26, 2012	Peter Liu
2. **Arrhythmias**	September 5, 2012	David Birnie
3. **Atherosclerosis, Thrombosis & Vascular Injury and Repair**	September 6, 2012	Ruth McPherson, Phil Wells and Duncan Stewart
4. **Cardiac Imaging & Biomarkers**	September 13, 2012	Rob Beanlands
5. **Prevention, Population Health & Health Policy**	September 18, 2012	Andrew Pipe
6. **Technological Innovation, Clinical Evaluation & Longitudinal Follow-up**	September 20, 2012	Marc Ruel and George Wells

Each session had between 10 and 20 participants, which, overall, included representation from the UOHI, University of Ottawa, Carleton University, Champlain Cardiovascular Disease Prevention Network, Children's Hospital of Eastern Ontario, Heart & Stroke Foundation of Canada, Health Canada, National Research Council, The Ottawa Hospital, Ottawa Hospital Research Institute, the Canadian Stroke Network, and the Public Health Agency of Canada. During these sessions, participants engaged in Strength, Weaknesses, Opportunities and Threats (SWOT) analysis and strategy setting. The setting was informal and over dinner, which allowed for excellent networking amongst participants, who may not frequently interact.

Each participant also completed a questionnaire specific to that Think Tank session and those invitees unable to attend were engaged for their thoughts and feedback, at minimum, through completion of these questionnaires. Out of these sessions and their associated compiled questionnaires, a number of recommendations were identified. (All the recommendations for each individual session are available upon request.) The following is the set of recommendations that were common to all Think Tank sessions:

- Prioritize the areas where Ottawa can lead and link these priority areas to investment strategies
- Optimize strengths of current research programs
- Build new programs, where opportune, that have a high potential for success
- Strategically recruit and train in the identified priority areas, including cross-disciplinary training and hiring of support personnel to enable more dedicated research time for investigators
- Find opportunities to build bridges and break down silos among researchers, institutes and programs—create collaborative networks in specific areas
- Brand and promote the research excellence that already exists—create awareness
- Exploit and be opportunistic of alternative funding support
- Develop clinical trials capacity—multi-centre, high-content, innovative design
- Hold more brainstorming sessions to generate high impact "killer" ideas and as a means to facilitate collaborations

Be regional in approach in building programs

Strategic Retreat in September 2012

The strategic retreat was held at the Lord Elgin Hotel on Saturday, September 29, 2012. Approximately 70 participants attended, with representation from scientists at Ottawa-based institutes, universities, hospitals and industry. (For the schedule of the day, see Appendix B).

Building on the collective deliberations and recommendations of the six Think Tank sessions, the retreat aimed to:

1. Strategize priority themes for pursuit of the vision of the Ottawa region becoming the #1 cardiovascular centre in Canada and among the top five internationally
2. Identify the Innovation Clusters and programs that can support the priority themes
3. Consider the key enablers and barriers to fulfilling the priority themes identified
4. Identify cross-disciplinary and cross institutional collaborations and programs that would facilitate delivering on the priorities of the strategic plan.

In brief, the retreat began with addresses from Dr. Robert Roberts, CEO of UOHI; Dr. Mona Nemer, VP Research, University of Ottawa; Dr. Bernard Jasmin, Vice-Dean of the University of Ottawa; and Dr. Duncan Stewart, CEO of the Ottawa Hospital Research Institute. This was followed by a presentation from Dr. Peter Liu on his vision for cardiovascular research in the Ottawa region with a look at the current research funding landscape and current clinical, technological and research trends. The recommendations of the six Think Tank sessions were presented by the Chairs of each session (This was complemented by posters of each session on display, as well as detailed reports in the participants' packages). Following this, Dr. Liu gave an overview of the common strengths, weaknesses, opportunities and threats (SWOT) of the Ottawa region, which were collated following the feedback from each of the Think Tank sessions. With all of this information in mind, the participants were then asked a number of questions which they reviewed and discussed in breakout groups.

Key recommendations and outcomes of the retreat included the identification of four overarching research themes for pursuit by the Ottawa community over five years. These were:

i. Personal Tailored Health Solutions

ii. Novel Causes of Cardiovascular Disease

iii. Biomaterials, Technology and Human Health in Heart and Vessels

iv. Health Systems Innovations and Health Policy in Cardiovascular Health

A number of potential Innovation Clusters were identified that can deliver upon the priority themes, and among others, include 1) Inflammation and tissue repair in cardiovascular disease; 2) Protein – RNA interactions in cardiovascular disease development and progression; 3) Biomarkers and targets; 4) Patient-oriented technologies; 5) Regenerative medicine; and 6) Community intervention studies and outreach with longitudinal follow-up.

Potential enabling platforms that can be built or developed upon, which link with these themes, were also recognized. These included: biobanking, bioinformatics and computational biology, clinical trials methods, functional and molecular imaging and -omics investigations. Common enabling strategies were also identified.

In summary, the retreat was well attended by key stakeholders in the Ottawa region, breakout session discussions were innovative, informative and visionary and, together with the recommendations of the six Think Tank sessions, resulted in a key set of recommendations that have gone on to form the blueprint of this 2013-17 Strategic Plan.

2013–17 STRATEGIC PLAN

Overview of Research Themes

Through a multi-institutional, multi-disciplinary, stakeholder-driven, participatory process, including input from over 100 investigators and partners, six Think Tank sessions, and a major regional retreat, our forward research strategy will focus on four interrelated themes, together with six enabling platforms. These four research themes aim to address major health needs in cardiovascular medicine of tomorrow and facilitate the acceleration of biomedical progress. They build on existing foundations of strengths, anticipate the cutting edge, create an environment for collaborative training, and promote opportunities for leverage. They also have the inherent capacity to expand across the country and internationally, leveraging Ottawa's leadership and expertise, to promote interaction across networks, and maximize impact.

The four research themes are: (1) Personal Tailored Health Solutions; (2) Unlocking the Key Causes of Cardiovascular Disease; (3) Optimizing the Technology and Human Interface in Heart and Vessels, and (4) Community Intervention, Health Systems and Health Policy Innovations in Cardiovascular Health.

Priority Theme 1:
Personal Tailored Health Solutions

The Need:

As a result of major large scale international clinical trials and the development of practice guidelines, a major trend in cardiovascular medicine is the development of care pathways and utilization of medicines that are mandated for every patient with a specific diagnosis. The current clinical practice guidelines and disease care pathways, while enormously successfully in standardizing practice and reducing morbidity and mortality, have significant drawbacks that demand new solutions. These guidelines treat all patients as identical and subject all individuals to the same algorithm of diagnosis and treatment, irrespective of patient risk profile or response patterns. While recognising that clinicians provide treatment directed to the individual to the best of their abilities, the current standards of care, for the most part, do not differentiate between those patients who will derive the maximum benefit from a specific treatment and those who will simply experience multiple side effects. This leads to massive escalation in the cost of care and non-adherence of the patient to treatment, while diminishing the impact of therapy. Therefore, the existing mechanisms of diagnosis and treatment of cardiovascular conditions are no longer tenable.

The theme of “Personal Tailored Health Solutions” aims to customize diagnostic and treatment strategies to the patient’s unique individual characteristics, risk profile, disease characteristics and response patterns, to lead to a more cost-effective approach, and is contrary to the currently accepted approach in cardiovascular medicine.

The Strengths and Leadership Potential in Ottawa:

Several on-going programs and available expertise make the Ottawa region and the Heart Institute particularly well suited to lead in this theme:

1. Genetic testing technology and profiling expertise for coronary disease and cardiometabolic syndrome led by Drs. Roberts and McPherson;
2. Proteomic testing technology and innovative biomarkers for heart failure and arrhythmias led by Dr. Liu;
3. Bedside point-of-care testing technology for pharmacogenetics evaluation of drug response gene variation (RAPID GENE) led by Dr. Derek So;
4. Large patient population with opportunity for biobanking and outcome tracking;
5. Leading experts on clinical trials methods to stratify treatments to responsive populations (e.g., UOHI Cardiovascular Research Methods Centre);
6. Ottawa Medical Physics Institute (OMPI) at Carleton University;
7. Ottawa Institute of Systems Biology.

Drs. Ruth McPherson, Robert Roberts and Alexandre Stewart unlocked a DNA sequence that boosts heart disease risk by 40 per cent regardless of other factors.

The Goal:

We aim to develop effective predictive biomarkers, risk evaluation tools, clinical decision aids, and effective monitoring strategy to optimize the treatment tailored to the characteristics of the individual patient. This will lead to entirely novel diagnostic and therapeutic approaches to cardiovascular disease and transform the paradigm of practice.

The goal for this theme is to create an internationally recognized Centre of Excellence in Personal Tailored Cardiovascular Medicine.

The Competitive Landscape:

In Canada, the only centres that have preliminary activities in this area include Montreal Heart Institute, whose focus is generally on pharmacogenetics, and the University of British Columbia, Prevention of Organ Failure (PROOF) Centre of Excellence, which has early stage biomarkers in heart failure, transplant rejection and lung diseases. We have on-going collaborations with both of these centres. Our human genetics, RNA and proteomics strategies across different conditions make us the definitive leading edge centre in Canada.

In the U.S. and globally, this is a very "hot," moving area, with several major U.S. centres, including Harvard, Hopkins, Duke and UCLA pursuing these concepts to some degree. However, we are on external expert review panels for a number of these programs, and we are further ahead in our research, though these centres are very well funded (~$3 million/ year/centre). Finally, in terms of genomic sequencing, the number one country in the world is now considered by many to be China. For example, Beijing Genomics Institute (indirectly funded by the Chinese government) now services the majority of private sector clients around the world and,receives large-scale grants globally to sequence a wide variety of organisms from viruses, bacteria to primates and humans.

Dr. Robert Beanlands
Chief of Cardiology,
Director of the National
Cardiac PET Centre,
Director of the Molecular Function
and Imaging Program, UOHI

The Activities to Be Undertaken

To achieve this goal, the Ottawa region will:

- Begin by creating an Innovation Cluster in Personal Tailored Cardiovascular Medicine that will, in five years, have converged into the Centre of Excellence in Personal Tailored Cardiovascular Medicine. The Innovation Cluster will focus on four priority disease programs, which have been identified through the strategic planning process as **heart failure, atrial fibrillation, vascular/ cardiometabolic diseases and valvular diseases**. We will develop novel approaches to these key disease areas.

- Build on our strengths in **systems biology,** as applied to the cardiovascular system STET to identify and validate novel relevant biomarkers that will impact on clinical decision making that can be validated in multiple populations. These will include genomics, proteomics and novel tools in RNA. These markers will be multiplexed to derive the most effective and cost-effective decision making tools.
- Enhance our strengths in **multi-modality imaging**, with an enhanced emphasis on etiologically-specific imaging strategies matched to clinical outcomes. The clinical imaging strategies will also be integrated with biomarkers being developed, such that the decision making process will be staged and interfaced (e.g., biomarker-based screening, followed by imaging where appropriate for critical therapeutic choices). These cutting edge imaging tools will help to further refine our ability to make critical decisions, and develop tools for replication in other cardiovascular centres (cross-reference: Theme 3).
- Develop and lead in the application of **new clinical trial designs**. These include clinical evaluative strategies, including adoptive trial design, cumulative single-patient (N-of-one) trials, network meta-analysis, and micro-simulations as examples to evaluate tailored clinical decision making and stratified therapies.
- Develop **novel tools and applications** suitable for **point-of-care** use at the bedside. These applications will increase the speed and efficiency of the clinical diagnostic and decision making process. UOHI already has significant expertise in this area (e.g., RAPID GENE point-of-care genetic test for the CYP2C19*2 gene variant for guiding and improving treatment of patients undergoing stent procedures), which will be expanded upon over the next five years. These tools will be embedded in electronic medical records (EMRs) to facilitate patient-centred clinical decision making to optimize and validate outcomes.
- Develop expertise in **medical risk modelling, decision simulation** and **cost-effective analysis** (cross-reference: Theme 4). Evaluate cost-effective and clinical efficiency modelling of strategies to maximize impact of novel means of clinical decision making.
- Develop a **cardio-oncology** collaborative group of cardiovascular and cancer researchers to investigate cardiovascular complications of cancer therapeutics

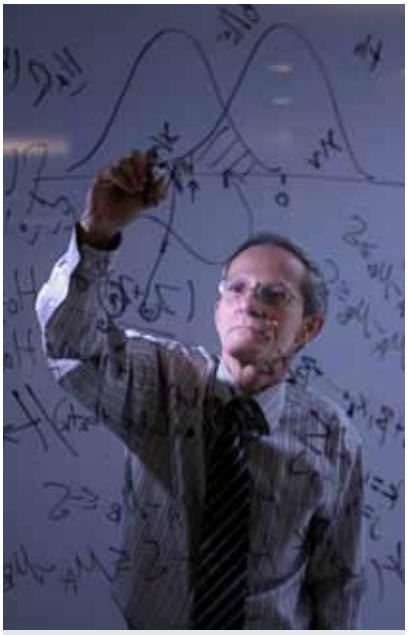
Heart Institute cardiologist Dr. Derek So (left) and resident Dr. Jason Roberts (right) led the RAPID GENE trial, which proved the clinical effectiveness of the first-ever point-of-care genetic test.

Drs. Rob deKemp, Ran Klein and Jennifer Renaud of the FlowQuant team.

The People

To develop leadership and expertise to deliver on the described activities, the Ottawa region will:

- Identify and promote expertise in novel **customized clinical and decision tools** to simplify clinical care and maximize impact, while tailoring the decision making to the key biological, clinical, prognostic and historical characteristics of the patient.
- Recruit or develop/harness expertise in **clinical and biological informatics** to design appropriate data mining and validation strategies to optimize effective clinical decision making.
- Develop our intra-institutional expertise in systems biology, or recruit individuals with specialized expertise in proteomics or RNA markers and biology to increase our ability to process novel biomarkers and provide core facilities to evaluate markers in other cohorts.
- Recruit or develop **clinician-investigators** with disease content expertise who understand the philosophy and utility of these novel tools for personal tailored medicine, and who will design appropriate **clinical evaluation trials** and **biobanking methods** to determine the most appropriate approach for specific patient populations.
- Harness our extensive **multi-modality imaging** expertise, with an enhanced emphasis by personnel on molecular imaging and clinical outcomes.



Dr. George Wells
Director, Cardiovascular Research Methods Centre, UOHI

The Technology & Infrastructure

To achieve the above goal and the associated activities, the Ottawa region will:

- Require the availability and access to cutting-edge **systems biology platforms**, including rapid analysis of genomic, proteomic and RNA information, and informatic analysis of the information acquired.
- Initiate and build an appropriately designed **biobank** that harnesses the large number of patients available. The biobank will have privacy and consent provisions and a barcoded retrieval system for targeted populations for tailored medical decision making.
- Expand the **Cardiovascular Research Methods Centre,** led by Dr. George Wells at UOHI, in terms of recruiting a bioinformatician as well as individuals familiar with biomarker-based clinical trial design.
- Harmonise and link currently employed **clinical databases** for use by researchers for obtaining information on patient inception of care, to intervention, and to outcome databases such as that from the Institute of Clinical Evaluative Sciences (ICES), Canadian Institutes of Health Information (CIHI) or Ontario Drug Benefit Program eFormulary.
- Form an Ottawa region informed human **Research Ethics Review Board** to assess appropriate trial designs while providing maximum patient protection, process accountability and provide on-going auditing of the approval process.

Engaging Partners

We will engage the following partners to ensure success of this strategy:

- Private sector partners (pharmaceutical, device and diagnostic companies) with the appropriate intellectual property protection policy and procedure.
- Disease management groups and guideline experts for specific targeted clinical decision making to change the paradigm of practice, e.g., heart failure, atrial fibrillation, coronary disease, etc.
- Health systems and health policy experts to ensure adoption.
- Regulatory authorities (European Medicines Agency (EMA), FDA and Health Canada).
- Private sector partners in information technology, diagnostic platforms and data integration into EMR and clinical decision tools.
- University groups in health informatics, health economics, and health data access (e.g., CIHI and ICES).

Deliverables (Outcome Indicators):

- Cluster participants and leaders identified for each of the above
- Recruitment process in place for scientists, clinician-scientists and methodology experts identified
- Infrastructures secured or plans for acquisition in place
- Planned projects started
- Leverage of funding through peer-reviewed agencies and private sector partners
- Publications
- Trainees

PRIORITY THEME 2

Unlocking Novel Causes of Cardiovascular Disease

The Need:

The current paradigm of cardiovascular diseases is that all the conditions arise from known risk factors such as hypertension, diabetes, hypercholesterolemia and smoking. It has been promoted that 90% of all cardiovascular disease can be accounted for by these factors, and thus no further research on cardiovascular disease causes is needed. There have been large successes in Canada in reducing these risk factors. Indeed, Canada has the lowest smoking rate in the world and excellent blood pressure control. Specifically, from the Ottawa region, programs such as the Ottawa Model for Smoking Cessation and the Champlain Cardiovascular Prevention Network have been widely influential in cutting these risk factors.

While the benefits to these prevention strategies for known risk factors cannot be overstated—the control of the risk factors and innovations in treatments have contributed to the lowering of acute mortality from myocardial infarction and stroke—the reality is that despite reduced smoking, first-rate hypertension control, and excellent cholesterol lowering, we have not seen cardiovascular disease disappear. Chronic conditions such as heart failure, atrial fibrillation and chronic valvular diseases are paradoxically on the increase. Typically patients now present with a much lower burden of these commonly recognised risk factors, yet the disease is just as devastating.

As such, these clinical observations together with recent research data suggest that we need to re-examine the causes of cardiovascular disease, both inherent to the patient (nature) and environmental (nurture). Processes such as innate immunity and metabolic reprogramming, tissue remodeling and fibrosis, infectious triggers and endogenous microbiome, protein quality control, tissue regeneration and repair, epigenetic and RNA regulation of organ defence and disease phenotype all have crucial roles to play. Understanding these novel disease processes is critical for us to devise novel diagnostics and therapeutic approaches.

The Strengths and Leadership Potential in Ottawa:

The Ottawa region has significant strengths to address these novel disease processes and can be a leader in new cardiovascular disease etiology and pathophysiology:

1. We are already prominent in the development of innovative biomarkers to identify diseases, from genomic and proteomic analyses and the function of these markers to identify novel disease pathways;
2. The Ottawa region has leading-edge researchers in atherosclerosis/vascular diseases, heart failure, pulmonary hypertension and protein-protein interactions;
3. We have significant leadership at different sites in stem cell and cell-based models of human diseases (e.g., Sprott Centre for Stem Cell Research led by Dr. Michael Rudnicki);
4. We are already utilizing state-of-the-art imaging infrastructure to provide *in vivo* localization of disease targets in human patients;
5. We have access to unique animal models of disease in Ottawa (e.g., Transgenic Core at the University of Ottawa)

Dr. Katey Rayner
Lab Director, Cardiometabolic microRNA and Epigenetics Laboratory, UOHI

Dr. Duncan Stewart
CEO, Scientific Director and Senior Scientist in the Regenerative Medicine Program at the Ottawa Hospital Research Institute (OHRI)

The Goal:

We will fast-track new insights into disease pathophysiology through the functional insights of genetic and proteomic biomarkers as well as imaging observations derived from Theme 1, together with the availability of patient materials and patient follow-up to unravel novel causes of cardiovascular diseases. We will address key questions including why plaques rupture in the coronary arterial system, why the heart dilates or becomes stiff and fails, and why the atria remodel and block conduction to exacerbate atrial fibrillation.

From these insights, we will move towards the development of a *Centre of Excellence in Novel Cardiovascular Diagnostic* and Therapeutics that addresses the novel fundamental causes of cardiovascular disease. We will derive novel diagnostic tools, and therapeutic targets, including innovative technologies (cross-reference: Theme 3). We will work with private sector partners to co-develop novel targets into clinically testable entities. We will also track longitudinal outcomes of patients receiving specific diagnostic studies or therapeutic interventions in the community, to ultimately impact health policy (cross-reference: Theme 4).

The Competitive Landscape:

In Canada, the only centres that have significant systems biology studies of novel disease processes and identify novel targets in heart and vascular diseases are Mazankowski Heart Institute in Alberta, with a focus on cardiac metabolism, and University of Toronto, with strong basic science departments. However, the linkages between basic science and clinical departments are generally less robust than UOHI and regional centres. Therefore, with the existing people and infrastructure, and some enhancements to resources, the ability for Ottawa to provide a leading edge is substantial.

The Activities to Be Undertaken:

To achieve this goal, the Ottawa region will:

- Evaluate the **functional role of the newly identified biomarkers and imaging targets** (derived from Theme 1) using various model systems, such as regenerative medicine "disease in a dish" modelling of developing and mature component heart cells, and appropriate animal models to mimic the clinical disease.
- Harness **human tissues** from surgical or interventional procedures and prepare them for acute physiological, cytological and live cell dynamic signalling analysis of *in vivo* human biology and disease processes, correlated with diagnostic studies, and longitudinal follow up.
- Identify **novel genes, proteins and signalling pathways** that have potential to be used as diagnostic biomarkers as a probe for novel pathophysiological processes (cross-references: Theme 1)
- Develop **novel molecular imaging labels** for three-dimensional analyses of disease processes in patients to gain unique insights into the relationship of location and geography to function and outcome.
- Develop **new therapeutic tools** (drugs, biologics, devices or cells) in partnership with the global sector to address these new pathophysiological pathways that can ameliorate the clinical outcomes in patients.

The People:

To develop leadership and expertise in this area, the Ottawa region will:

- Form **Clusters of Innovation** that bring people together from across the Ottawa region to unravel the novel pathways of cardiovascular disease formation, e.g., inflammation and immunity; protein quality control and necroptosis; oxidative stress and mitochondrial coupling; etc. This will ultimately form the Centre of Excellence in Novel Cardiovascular Diagnostic and Therapeutics.
- Develop, identify or recruit individuals who are able to **manage the biobank** with precision without breaches in privacy or errors in sample handling (cross-reference: Theme 1).
- Foster the expertise of individuals who can perform human tissue analysis from biopsy and surgically excised or freshly autopsied hearts using **live cell imaging** devices.
- Recruit or develop expertise or collaborate with experts in **single-cell and integrative physiology** and **molecular network monitoring** to unravel the key abnormalities leading to the human disease processes.
- Develop expertise in the **development of new biomarkers and diagnostic tools** that validate fundamental mechanisms of disease and which can be translated to the clinical setting for decision making (cross-reference: Theme 1).
- Recruit or develop clinician-investigators or epidemiologists with disease content expertise who can **interrogate large databases** that include clinical characteristics, sophisticated biomarker/imaging study information, and outcome differentials to determine the genetic-environmental contributions and unique pathways to disease development vs. healthy adaptation.
- Harness expertise and collaborate with experts in the Ottawa region in unique novel tools, such as **nanodiagnostics and photonics,** which can provide new biosensing information that can be remotely transmitted, and that was not previously possible to obtain (cross-reference: Theme 3).

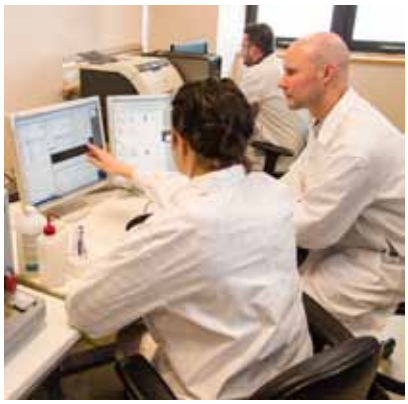
Dr. Myra Cocker
Cardiac Imaging Post-Doctoral Research Fellow, Molecular and Function Imaging Program, UOHI

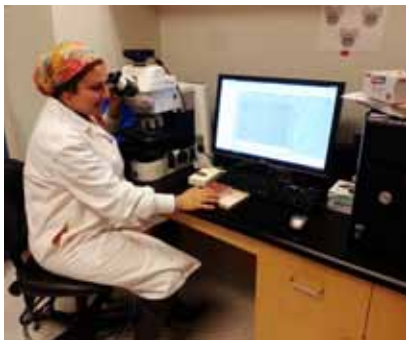
Dr. Marie-Elodie Cattin
Post-Doctoral Fellow, Cardiovascular Endocrinology Laboratory, UOHI

The Technology & Infrastructure:

To achieve the above goals, the Ottawa region and UOHI will:

- Acquire the availability and access to platforms for **single-cell live** physiological and molecular monitoring and manipulation.
- Have access to **large clinical databases** interfaced with biomarker and imaging information. This will be facilitated by a database harmonisation project that will be undertaken during 2013.
- Ensure availability of large-scale **human stem cells** and **animal models** for functional evaluation. This will be possible through Ottawa-wide collaboration and expertise sharing between UOHI, the Sprott Centre for Stem Cell Research at OHRI, and the Transgenic Core at the University of Ottawa.
- Establish and operationalize a high-content molecular pathology core facility, currently being set up at The Ottawa Hospital, Civic Campus, Loeb Building.
- Develop a **biobank** that is secure and privacy protected, but appropriately annotated with linkable clinical information (cross-reference: Theme 1)





Partners to Engage:

We will need the following partners to ensure success of this strategy:

- Disease pathophysiology experts, not only cardiovascular from but other related domains including immunology, neuroscience, RNA, epigenetics to epidemiology and clinical outcomes.
- Clinicians who conduct clinical diagnostic or therapeutic studies, and lead in the adoption of research findings into clinical practice.
- Private sector collaboration (pharmaceutical, device and diagnostic companies) to develop the newly identified targets.
- Health informatics, health economics, and health data access organizations within our university departments. Additional key partner organizations also include the Canadian Institute for Health Information (CIHI) and the Institute for Clinical Evaluative Sciences (ICESS).
- International collaborative research consortium.

Deliverables (Outcome Indicators):

- Cluster participants and leaders identified
- Recruitment process in place and candidates identified
- Infrastructures secured or plans for acquisition in place
- Integrated core pathology laboratory being consolidated at the renovated Loeb Building
- Collaborative projects started
- Leverage of funding through peer-reviewed agencies and private sector partners
- Publications
- Trainees

PRIORITY THEME 3

Optimizing the Technology and Human Interface in Heart and Vessels

The Need:

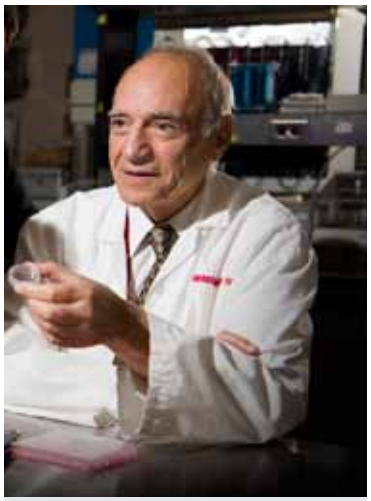
As the cardiovascular system requires electrical, mechanical and fluid dynamic coordination for its function, in addition to molecular and hormonal regulation, many of the solutions in cardiovascular diseases take advantage of advances in wide-ranging disciplines, including information technology, biomaterials, stem cells, imaging techniques, miniature sensors, intelligent feedback, and micro-robotics, among others. However, the seamless incorporation of the best technology to address clinical needs and the ability for the technology to inform biological events, remains an elusive challenge. For example, despite significant progress with implanted cardiac defibrillators (ICDs) and their demonstrated advantage against placebo control devices, the best outcome for the patient with an ICD (~$30,000 each) remains that of when the defibrillator never discharges, or is programmed to discharge minimally.

On the other hand, the modern photonic sensors, microfluidic chips, self-dissolving biomaterials and nanodrug delivery devices provide unprecedented opportunities for customized tailored medicine, closed-loop diagnosis and therapy, and remote monitoring. To determine the relative effectiveness of the different approaches in a dynamic environment requires new approaches for evaluation, regulatory approval and cost-effective decision making. Effective partnerships amongst the academic, private and government sectors are critical to move the innovation forward.

The Strengths and Leadership Potential in Ottawa:

The Ottawa region, being the prior home of the high technology sector and current principal base for the National Research Council of Canada, has numerous strengths in the technology domain:

1. There has been a long-standing history of technological prowess in cardiovascular applications in the Ottawa region with human use of the first artificial heart and its manufacture (World Heart Corporation);
2. The Medical Devices Innovation Institute at the University of Ottawa, created in 2009 and led by Dr. Tofy Mussivand;
3. The Ottawa region (UOHI and OHRI) has a very significant leadership position in stem cell biology (home of the Stem Cell Network) and regenerative medicine (cross-reference: Theme 2);
4. The UOHI cardiac imaging group has already developed many technology advances for various imaging modalities and software for analysis. This group has also secured several patents on the processes;
5. Existing leading-edge expertise in the cardiovascular matrix (supporting framework) in health and disease, and developing biomaterials and biotechnology to change the matrix;
6. Strong presence of high technology sector expertise as the previous national hub of technology, with excellent engineering schools at University of Ottawa and Carleton University, as well as technology innovation labs at the National Research Council of Canada.



Dr. Tofy Mussivand
Director, Cardiovascular Devices Program, UOHI & Institute Director and CEO, Medical Devices Innovation Institute, University of Ottawa

Ottawa Medical Physics Institute

OMPI is a network of medical physicists in Ottawa. It is a research unit of the Department of Physics at Carleton University.

The Goal:

We will promote the development of innovation clusters that bring together cutting-edge technology and patients with clinician-investigators who are able to fast track innovation to application. This will also promote the objective evaluation and comparison of different technological approaches and the development of benchmarks for novel technology platforms. UOHI and partners will develop appropriate evaluative technology to compare the relative effectiveness of technologies for health solutions. We will also develop key criteria and design prototypes to optimize intuitive human-machine interface. Eventually, we aim to establish a Centre of Excellence in Health Technology and Human Interface in Ottawa.

Dr. Thierry Mesana
Deputy Director General,
Cardiac Surgeon, UOHI
Professor of Cardiac Surgery,
University of Ottawa

Competitive Landscape:

In Canada, there are other major centres with technology expertise with strong biomedical engineering programs, including the University of Toronto, University of Waterloo, McMaster University, and the University of British Columbia. However, the interactions with cardiovascular researchers to translate ideas into products through the cycles of innovation, evaluation, feedback, and commercialization is rich in Ottawa, but less organized in many other centres. In the U.S., the competition is more intense, as the biomedical engineering schools with most noteworthy repute are all sited there, including Johns Hopkins, Georgia Institute of Technology, Duke University, Massachusetts Institute of Technology, University of Washington, and UC Berkeley.

Dr. Marc Ruel
Chief, Division of Cardiac
Surgery, UOHI
Professor and Chair, Cardiac
Surgery, University of Ottawa

The Activities:

To achieve this goal, the Ottawa region will:

- Establish an **Innovation Cluster in Biomedical Devices** that brings technology experts together with clinicians to identify critical clinical needs and facilitate the emergence of most-optimal technology solutions ("killer applications") through partnership and multi-party funding models.

We aim to establish a Centre of Excellence in Health Technology and Human Interface in Ottawa.

- Enhance further our knowledge transfer and exchange capacity in **telemedicine and tele-support** infrastructure programs, such as those done for myocardial infarction and heart failure, and develop innovations in this domain.
- Develop specialized multidisciplinary expertise in **regenerative cardiovascular medicine**, including integrated biomaterials, enhancement of intrinsic cardiac repair mechanisms and reprogramming of grafted and host cells to maximize restoration of function. (cross-reference: Theme 2)
- Expand on existing **information technology, biosensors,** and **intuitive interactive platforms** to anticipate the next major frontier, such as smartphone interfaces or private medical frequency bands for developments, or convergence interfaces (e.g., iPads) which can promote health, detect disease early, and provide feedback and adherence to therapy, and community follow-up.
- Continue to explore applications of **nanotechnology and biophotonics** in cardiovascular medicine, and develop prototypes for clinical testing and evaluation.
- Develop an **Innovation Cluster in Surgical Technology Innovations** that could include research on hybrid surgical approaches, mechanical heart, novel valvular repair or cardiovascular replacement therapies.
- Promote expertise in the design, implementation and improvement of methods in the **evaluation of effectiveness of technology innovations** as applied to medicine, for quality improvement, regulatory approval, and cost-effective modelling.
- Work with OHRI and the Toronto Health Economics and Technology Assessment Collaborative (THETA) to develop **cost-effective modelling** of new technologies to ensure feasibility of support through the health care system and inform policy and funding from governmental agencies.
- Develop and protect novel ideas that address critical needs, and seek **commercialization** partners to develop prototypes for testing, improvement and, ultimately, apply for regulatory approval, and dissemination of use.

The People:

To develop leadership and expertise in this area, the Ottawa region and UOHI will:

- Recruit or develop expertise or collaborate with **experts in novel technologies** with a potential to solve critical health problems and to foster collaborative research programs.
- Recruit or develop expertise in the **novel methodologies** in the **evaluation** of on-going technological developments.
- Develop clusters of existing experts together with clinicians and technology development teams to move forward developments and **evaluations**.

The Technology & Infrastructure:

To achieve the above goals, the Ottawa region and UOHI will:

- Enhance the infrastructure (including the Cardiovascular Research Methods Centre at UOHI and technology testing platforms) to **evaluate the comparative effectiveness** of technologies in addressing health care needs.
- Develop methodologies to help in the evaluation of the **impact, barriers and cost-effectiveness** of novel technologies in a dynamic changing environment with agencies and partners.
- Establish **standards of measurement** of machine-human interface in terms of intuitiveness, consistency, control, feedback, learning and satisfaction.
- Create **integrative platforms** from which new technologies can be compared to each other, and integrated to determine the best configuration to maximize the impact for a specific application.
- Enhance access to high technology health solutions through public and semi-private forums of team-to-team discussion.

Partners:

We will need to engage the following partners to ensure success of this strategy:

- Technology partners: Schools of engineering and bioengineering, the National Research Council of Canada, technology companies, international research groups or consortia.
- Academic partners: Consortium of technology savvy innovators and clinicians who are familiar with the technology interface to develop solution-driven innovations.
- Private sector partners: Technology innovation companies or those who provide the interface or broker collaborations or invest in innovations are all critical to protect IP and permit onwards development.

Deliverables (Outcome Indicators):

- Cluster participants and leaders identified (recruitments in place as appropriate)
- Infrastructures secured or plans for acquisition in place
- Projects started
- Leverage of funding
- Publications
- Trainees

PRIORITY THEME 4

Community Intervention, Health Systems and Health Policy Innovations in Cardiovascular Health

The Need:

Innovation is the key to addressing gaps in Canada's public funded health care system. Top of mind for government is the reduction of health care spending through investments in high-impact, upstream prevention of disease and innovative health systems, transformation to improve quality and efficiencies. Develaping a sophisticated understanding of how to design and deliver high quality preventive polices and programs to impact the health of a population is an important emerging area of research. In addition, quality health care and health systems reformare front and centre in regards to addressing cardiovascular health worldwide. The emerging challenges of chronic disease management include the creation of a seamless continuum of care from community to hospital and the transitions in between, offering significant opportunities for innovation and knowledge translation.

As the sole speciality cardiovascular centre in the Champlain region, with excellent community intervention networks, such as the Champlain Cardiovascular Disease Prevention and Management Network, already in place, the UOHI and its partners are uniquely positioned to innovate, advise and model state-of-the-art community pragrams and health system improvements.

The Strengths and Leadership Potential in Ottawa:

The Ottawa region already has several leading edge programs in community studies and/or health policy research:

1. The Champlain Cardiovascular Disease Prevention Network (CCPN), headed by Dr. Sophia Papadakis and Dr. Andrew Pipe at UOHI, is providing leadership for multi-sectoral action to deliver integrated, innovative, evidence-based policies and programs to improve the cardiovascular health of Champlain residents. The CCPN comprises partners from public health, specialty care, primary care, hospitals, education, community, industry, and academia;
2. The Ottawa Model for Smoking Cessation, led by Drs. Andrew Pipe, Bob Reid and their team at UOHI, is now the standard of practice in clinical approaches to addressing tobacco in hospitals and primary care practice across Canada and beyond.
3. The C-CHANGE (Canadian Cardiovascular Harmonized Guideline Endeavour) initiative headed by Dr. Liu and other CVD stakeholders has now been adopted across Canada, including Ontario as the standard guideline for implementation;
4. University of Ottawa Institute of Population Health, including the R. Samuel McLaughlin Centre for Population Health Risk Assessment;
5. The Canadian Cochrane Centre based at The Ottawa Hospital;
6. The University of Ottawa, Faculty of Medicine's Centre for Global Health;
7. Proximity to federal government and currently offering some advice regarding policy changes and implementation.

Drs. Andrew Pipe, Bob Reid and Ms. Kerri-Anne Mullen (PhD candidate and Network manager) of the Ottawa Model for Smoking Cessation, Division of Prevention and Rehabilitation, UOHI.

The Goal:

We aim to support existing research and knowledge translation networks involving the community and Ottawa/Champlain region cardiovascular providers to design, implement and evaluate novel health program innovations and health system interventions. Where gaps exist, we will promote the development of new networks. We will also evaluate policies that have been introduced by tracking outcomes in community-based roll-outs either with cluster randomized trials or sequential roll out implementation to determine impact.

Competitive Landscape:

In Canada, other centres with health policy research include University of Toronto (ICES), University of Alberta (Approach) and the University of British Columbia (Centre of Health Policy). Globally, there are many excellent schools, including the Kennedy School at Harvard, Johns Hopkins, Goldman School at UC Berkeley, Wilson School at Princeton, Sanford School at Duke among others. However, there are systematic differences in Canadian vs. U.S. health systems, and the health policy frameworks are fundamentally different, even though there are rich opportunities for comparison and contrast.

The Activities:

To achieve this goal, the Ottawa region will:

- Build and enhance research networks that can implement and evaluate **novel health delivery programs** or health system innovations and recommend policy changes at different levels of government (local, provincial, federal and international).
- Work with experts in the Ottawa health system and partners in the Champlain region to develop innovative **programs in chronic disease prevention and management**, including maintenance of health, continuum of care, patient-centred care and management of transitions.
- Develop a **Northern Canada Cardiovascular Research and Implementation Strategy** with federal and provincial governments, and UOHI experts to identify the factors leading to high cardiovascular disease burden, and potential solutions from healthy living styles to early risk detection.
- Partner with governmental and other academic institutions to develop a Centre of Excellence in Community Intervention, Health Systems and Policy Research, to evaluate health policies with evidence, and establish framework for the development of new policies.
- Be the major research partner in regional and national health policy networks, including the **Heart and Stroke Foundatoin of Ontario Vascular Strategy**, Vascular Network across Canada, the **National C-CHANGE Initiative** and Vision 2020 from the UN Summit on Chronic Diseases, among others.

The People:

To develop leadership and expertise in this area, the Ottawa region and UOHI will:

- Harness the regional experts into **Innovation Clusters for Health Policy Intervention** that can build community research networks to address key questions.
- Recruit or develop expertise in **health system innovations and evaluation** to provide leadership in the area of health systems design and outcomes analysis.

The Technology & Infrastructure:

To achieve the above goals, the Ottawa region will:

- Require expertise in novel approaches in research methodology, and the capacity to conduct these complex community interventions.
- Ensure maintenance of existing networks such as CCPN to provide infrastructure for on-going research studies.
- The ability to monitor patient outcomes and evaluate quality of care in cluster samples in the Champlain region, using ICES and CIHI data linked to UOHI and Ottawa region databases.

Partners:

We will need to engage the following partners to ensure success of this strategy:

- Public Health Agency of Canada
- Health Canada
- Ministry of Health of Ontario and Long Term Care
- Provincial Ministries of Health across Canada
- Public Health Networks in the various provinces
- Champlain Local Health Integration Network (LHIN)
- Primary care networks
- Other cardiovascular providers in the Champlain LHIN
- Institute of Clinical Evaluative Sciences and Canadian Institutes of Health Information
- World Heart Federation

Deliverables (Outcome Indicators):

- Cluster participants and leaders identified (recruitments in place as appropriate)
- Infrastructures secured or plans for acquisition in place
- Projects started
- Leverage of funding
- Publications
- Trainees

Centres of Excellence that Will Make Up ORACLE[1]

1. Centre of Excellence in Personal Tailored Cardiovascular Medicine
2. Centre of Excellence in Novel Cardiovascular Diagnostic and Therapeutics
3. Centre of Excellence in Health Technology and Human Interface
   This will include Innovation Clusters in Biomedical Devices and in Surgical Technology Innovations
4. Centre of Excellence in Community Intervention, Health Systems and Policy Research
   This will include an Innovation Cluster for Health Policy Intervention

1 In this strategic plan, some or all of the mentioned Centres of Excellence will initially form as Innovation Clusters. An Innovation Cluster is the convergence of people and/or technology of diverse origins that together functions as a new unit to solve to a major research question. This lateral connectivity creates innovation, maximizes leverage, generates efficiency and grows through multi-disciplinary interaction. An Innovation Cluster is the foundation of and has the potential to grow into a Centre of Excellence.

Six Enabling Platforms

1. **Human Research Ethics Board (HREB):** A major barrier to clinical research success has been the often lengthy delays in obtaining study approval by the Research Ethics Board. The Board must be fully accountable in terms of regulatory compliance, including Health Canada, the Tri-Council Policy Statement, ICH-GCP Guidelines and the Ontario provincial legislation on privacy (PHIPA), to ensure patient protection, while also managing the administrative/operational activities in an efficient and timely manner. The strategic planning process has identified a requirement for the formation and implementation of a Regional Research Ethics Board jointly with TOH/OHRI. Through this new process there will be increased accountability, proactive identification of problems, and other demands to ensure an effective and well-functioning Research Ethics Board, which is a critical platform to ensure the deliverance of the strategic research priorities.

2. **Functional Linkages of Clinical Databases:** To determine the best options for personal tailored decision making and appropriate diagnostic strategies and disease management, it is important to link patient-level information with health outcomes and health system utilization. Currently, the databases are fragmented, developed by individual investigators (enterpreneurs), without prior plans to link these databases SOAS to connect inception of care, to intervention, to outcome. The effective linkages of the databases will serve to multiply the value of the information content, while providing rich foundations from which to ask important and timely questions to formulate and validate hypotheses.

3. **Biobank of Blood and Tissues, and Associated Clinical Databases:** To discover innovative disease-forming pathways and to develop and validate novel biomarkers and imaging tools, access to patient tissues and blood samples is critical. However, these samples will need to be archived in a safe and secure manner, with observance of conditions of storage, privacy legislation, appropriate consent, ease of retrieval and robust process for prioritization for access. The samples will also be anonymised during storage, with bar codes to allow linkages with clinical data during research retrieval, and de-identification as necessary.

4. **Effective Clinical Methods and Informatic Support:** To develop innovative research methods and support research studies, it is important to have appropriate expertise and adequate human resources and computation access to manage the data in a robust and secure way. The Cardiovascular Research Methods Centre under the leadership of Dr. George Wells will need to be expanded to accommodate the increased demand.

5. **Molecular and Multi-Modality Imaging:** As both a driver of innovation and supporting infrastructure for personal tailored health solutions, or mechanisms of disease, molecular imaging infrastructure is critical for the operationalization of the strategic plan. This includes the human resources, equipment and partners to ensure that this is world class in a globally competitive arena.

6. **Regional Cardiovascular Training Program and Training Support:** To promote excellence in training and to foster the leaders of the next generation, we will partner with the University of Ottawa, Ottawa Hospital Research Institute, Carleton University and allied research institutions to develop a joint training program and attract the highest quality trainees, both to benefit from the research program and to contribute to its productivity and reputation.

Disease Areas for Priority Considerations

Heart Failure: Heart failure is the major chronic cardiovascular disease that incurs high costs of hospitalization and accompanying mortality. UOHI had a tradition of excellence in heart failure programs, and the artificial heart program is famous worldwide. Currently, there is a renewed focus in heart failure care innovations, ranging from basic science to regenerative therapies to clinical care models and health system innovations and prevention.

Arrhythmias – Atrial Fibrillation: The most common form of cardiac arrhythmias is atrial fibrillation, and its impact includes enhanced risk of stroke, heart failure and death. The Ottawa region is uniquely positioned to understand its pathogenesis, epidemiology and prevention, and develop clinical management innovations and remote monitoring in the community.

Vascular/Cardiometabolic Diseases: UOHI has a long tradition of excellence in research in atherosclerosis and vascular disease. This will continue to be an important focus with the ongoing vascular health strategies both locally and nationally.

Valvular Diseases: UOHI and regional partners have a tradition of excellence in valvular disease care through surgery and, now, percutaneous interventions. The ability to tailor treatments, identify innovations and track patient outcomes provides a unique competitive advantage nationally and internationally.

Governance

The high-level strategic plan will be approved by the Scientific Advisory Committee of the UOHI, the Board of Directors of the Ottawa Heart Institute Research Corporation (OHIRC) and the University of Ottawa Heart Institute. The strategic plan will also be presented to the University of Ottawa Faculty of Medicine and partner institutions for feedback and engagement.

The implementation of the strategic plan will be coordinated through an Executive Committee, with guidance from an evolved Steering Committee that would include individuals with both stakeholder and partner representation, but also content expertise. The implementation plan will include milestones, timelines, budgets, risk mitigation strategies and project deliverables.

An annual operating plan will be developed, which will be brought to the UOHI and OHIRC Boards of Directors for approval and ongoing monitoring of the implementation process. This will ensure the essential roles for the Boards in overseeing the successful deliverance of the goals of the strategic plan priority themes.

Partnership Engagement

For partners from each of the academic, governmental, public and private sectors, we will develop a partnership roundtable, with identification of very specific collaborative projects associated with people and actual deliverables. These partnerships will start with simple, achievable, small projects, building up to more ambitious, broad, multi-lateral major programs aligned with our major themes. The partnerships will be reviewed annually for success, relevance, new opportunities and leverage. The partnerships will be driven by mutual need and respect, focused on deliverables and built for shared success.

Creation of Virtual Cardiovascular Research Community

To promote research collaboration and formation of research clusters, the entire cardiovascular research community and core resources will be available on a searchable website to fast track linkages and sharing of ideas and resources to achieve global competitiveness.

APPENDICES

APPENDIX A – EXECUTIVE COMMITTEE AND STEERING COMMITTEE MEMBERS

Research Strategic Planning Executive Committee*	
Rob Beanlands	Chief of Cardiology, UOHI
Jean-Yves Dupuis	Chief of Anesthesiology, UOHI
Marion Fraser	VP Finance and Administration and CFO, UOHI
Alison Hosey	Manager, Research Administration, UOHI
Bernard Jasmin	Professor and Vice-Dean of Research, Faculty of Medicine, University of Ottawa
Peter Liu	Scientific Director, UOHI
Ruth McPherson	Director, Atherogenomics Laboratory and Lipid Clinic, UOHI
Thierry Mesana	Chief, Cardiac Surgery, UOHI
Andrew Pipe	Chief, Division of Prevention and Rehabilitation, UOHI
Marc Ruel	Cardiac surgeon and endowed chair of cardiac surgery research, UOHI
Duncan Stewart	CEO and Scientific Director, OHRI
Balwant Tuana	Professor, Cellular and Molecular Medicine, University of Ottawa
George Wells	Director, Cardiovascular Research Methods centre, UOHI

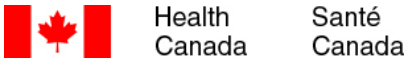
Research Strategic Planning Steering Committee*	
Dr Robert Beanlands	Chief, Division of Cardiology, UOHI
Dr David Birnie	Director of the Arrhythmia Service, UOHI
Dr Jean-Yves Dupuis	Chief, Division of Cardiac Anesthesiology
Ms Marion Fraser	CFO, Vice-President, Finance and Administration, UOHI
Dr Andrew Hill	Vascular Surgeon, TOH
Dr Bernard Jasmin	Vice-Dean of Research, Faculty of Medicine, University of Ottawa
Ms Coralie Lalonde	Chair, OHIRC Board of Directors, Katsura Investments
Dr Peter Liu (Chair)	Scientific Director, UOHI
Dr David Lohnes	Professor and Chair, Dept. of Cellular and Molecular Medicine, University of Ottawa
Dr Ruth McPherson	Director, Lipid Clinic & Atherogenomics Lab, UOHI
Dr Thierry Mesana	Chief, Division of Cardiac Surgery, UOHI
Dr Mona Nemer	Vice-President, Research, BMI, University of Ottawa
Dr Andrew Pipe	Chief, Division of Prevention & Rehabilitation, UOHI
Dr Robert Roberts	President & CEO, UOHI
Dr Marc Ruel	Professor of Surgery, Cardiac Surgery, UOHI
Ms Heather Sherrard	Vice-President, Clinical Services, UOHI
Dr Duncan Stewart	CEO & Scientific Director, OHRI
Dr Bernard Thébaud	Clinician-Scientist, CHEO
Dr Diem Tran	Clinician Investigator, Division of Cardiac Anesthesiology and Perioperative Medicine, UOHI
Dr Balwant Tuana	Professor, Cellular and Molecular Medicine, University of Ottawa
Dr George Wells	Director, Cardiovascular Research Methods Centre, UOHI

*The Steering Committee members have played a key role in the cluster Think Tank sessions, acting as Chairs and key advisors on topic areas, agenda setting and review of the reports. They have assisted with the identification of participants for the retreat together with the Executive Committee, which has provided operational oversight of the process to date. Going forward the Steering Committee will provide recommendations on the strategic plan priorities and will assist in the implementation processes.

APPENDIX B – SCHEDULE OF THE RETREAT

7:30 – 8:30	**Breakfast**	**Foyer**
8:30 – 9:00	**Welcome and Opening Remarks** (Chair: Ruth McPherson)	**Pearson A**
	Peter Liu, Scientific Director, UOHI – Welcome and purpose of the retreat	
	Robert Roberts, CEO, UOHI – Welcome to attendees and partners	
	Mona Nemer, Vice-President Research, University of Ottawa – Research priorities of the University of Ottawa	
	Bernard Jasmin, Vice-Dean Research, University of Ottawa – Training and collaborative opportunities through the Faculty of Medicine	
	Duncan Stewart, CEO, Ottawa Hospital Research Institute – Translational and clinical research	
9:00 – 9:25	**Overview of Changing Cardiovascular Research Landscape and Opportunities & Objectives of the Day**	**Pearson A**
	Peter Liu, Scientific Director, UOHI	
9:25 – 9:30	*Q&A and Discussion*	
9:30 – 10:15	**Think Tank Session Summary of Recommendations**	**Pearson A**
	(5 minutes each + 2 minutes clarification) Balwant Tuana, David Birnie, Ruth McPherson, Rob Beanlands, Bob Reid, Marc Ruel	
10:15 – 10:25	*Q&A and Discussion*	
10:25 – 10:45	**Health Break**	**Foyer**
10:45 – 11:15	**SWOT Summary and Collation of Possible Opportunities** **Peter Liu**, Scientific Director, UOHI	**Pearson A**
11:15 – 12:30	**Breakout Session #1 – Overarching Research Themes & Associated Flagship Innovation Clusters**	
12:30 – 13:20	**Lunch**	**Ontario**
13:20 – 14:00	**Reporting back – General discussion**	**Pearson A**
14:00 – 15:20	**Breakout Session #2 – Facilitating Innovation Clusters; Overcoming Barriers; Enabling Tools and Training Programs** *(Refreshments in Foyer)*	
15:20 – 16:00	**Reporting back – discussion on priorities and next steps**	**Pearson A**
16:00 – 16:10	**Closing comments:** Peter Liu	**Pearson A**

Ottawa Region Partners



The strategic planning activities were led by the University of Ottawa Heart Institute in close collaboration with the University of Ottawa. Ottawa region partner organizations that participated in the consultations, which formed the blueprint for this strategic plan, are indicated. The Ottawa Region for Advanced Cardiovascular Research Excellence (ORACLE) encompasses all of these organizations who will work together to deliver on the goals of this strategic plan.