

CRCHUM

CREATING
POSITIVE
IMPACTS

2018-2019 ACTIVITY REPORT





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Dr. Fabrice Brunet
President and CEO, CHUM



Dr. Vincent Poitout
Director of Research, CHUM

MESSAGE FROM MANAGEMENT

You have been at the helm of the CRCHUM for 5 years now. What's your assessment of the research centre's progress and its integration with the hospital?

VP We've come a long way in 5 years. Bringing the research teams together at a single site has fostered cross-fertilization among fields of expertise and has made it possible to share access to cutting-edge equipment. In addition to this important synergy, there's the ability to attract talent, related in part to the quality of our facilities, which now puts us on equal footing with internationally renowned institutions. The desire of the management to incorporate innovation and research into hospital activities has also allowed us to show how valuable research is for population health and health care.

FB The vision of research as a factor in the improvement of population health has been manifested in two ways: first, by increasing research quality and relevance and secondly by ensuring that the results of this research are quickly and directly applied to prove its value. This vision is in perfect alignment and synergy with that of the establishment.

Innovation in the field of health, especially through artificial intelligence, is central to our organization's values and actions. Where do we stand today with respect to the wider Canadian landscape?

FB We have to adopt artificial intelligence (AI) to change our ways of thinking and acting. Our corporate and integrative vision of AI is our assurance that it will be used relevantly to improve our performance and the health of our citizens. To support this vision, we created the School of Artificial Intelligence in Health. Unrivalled worldwide, this school is our guarantee of the social acceptability of our AI projects and their application for the benefit of the public. It's a good example of the research and innovation process through which discussions, partnerships, and collective intelligence provide answers to the challenges facing our organizations by involving all actors in the ecosystem.

During 2018, you paid special attention to initiatives such as CITADEL, the Therapeutic Innovation Unit, and Innove-Action. How will these initiatives lead to positive impacts for our patients?

VP Our Innovation Hub is already speeding up the process of applying knowledge to patient care and to health policies. In an era of big data, CITADEL gives us real-time access to information and facilitates decision-making in all our hospital activities. As for the Unit for Innovative Therapies, it allows patients whose treatment has failed to access new treatments, particularly in oncology.

FB With Innove-Action, the CHUM acts as a catalyst for ideas and shares its innovations for redesigning health care systems, both at home and abroad. How can we go beyond our walls; how can we make sure that patients benefit from proper health care once they go home? Redesigning the health care system doesn't mean changing our day-to-day procedures, but rather choosing to support our patients as they live their lives. To more quickly demonstrate patient benefits, we established the SERGIP barometer (care, teaching, research, management, innovation, patients), which ensures that all these dimensions become an integral part of our activities.

Generating new knowledge guarantees international exposure for organizations like ours. How can we ensure that we'll still be able to create knowledge in the future?

FB To meet the changing needs of the population, the research centre has chosen to have its teams concentrate on themes that answer questions asked by our patients. And we will continue in this same direction. This is one of the keys to generating new knowledge.

VP Knowledge that, most importantly, must be useful. So we need to be agile, to have the best experts who stay abreast of the latest developments and are able to quickly mobilize their knowledge or implement new ways of doing things. Our role is to provide them with the infrastructures and environment that allow them to remain leaders in their fields.

THE CRCHUM AT A GLANCE

One of North America's largest and most modern research centres, the University of Montreal Hospital Research Centre (CRCHUM) focuses on basic, clinical and population health research. It is the Université de Montréal's standard-bearer of biomedical science and health care research.

This fertile scientific breeding ground is home to more than 140 regular researchers, 330 investigators and some 460 students, who create and transform knowledge that makes a difference in patients' lives.

Producing internationally acclaimed scientific output, the CRCHUM has an operating budget of \$16M and an annual research income of \$60M. It is supported by its research teams and competitive infrastructures for early clinical research in Canada (Unit for Innovative Therapies) and by some fifteen core facilities for research support and services.

PATIENT- AND POPULATION-CENTRED

A backdrop to all the CHUM's hospital activities, our research stands out for its results, innovativeness, originality and dynamism. Our research is rooted in its community and in Quebec society.

We are a global leader when it comes to enhancing patient care, patient services and the patient experience. Our research is highly regarded in certain key sectors:

- Pathophysiology of solid tumours and related therapeutic intervention (oncology); pathophysiology of type 2 diabetes and its complications;
- Disease prevention through the adoption of good lifestyles or by changing lifestyles;
- Deciphering the mechanisms and developing state-of-the-art treatments for neurodegenerative diseases such as amyotrophic lateral sclerosis and multiple sclerosis;
- Canadian network of toxicology and comorbidities associated with the different types of hepatitis;
- New approaches in the fight against HIV.

THE CRCHUM'S SIX RESEARCH THEMES

CANCER

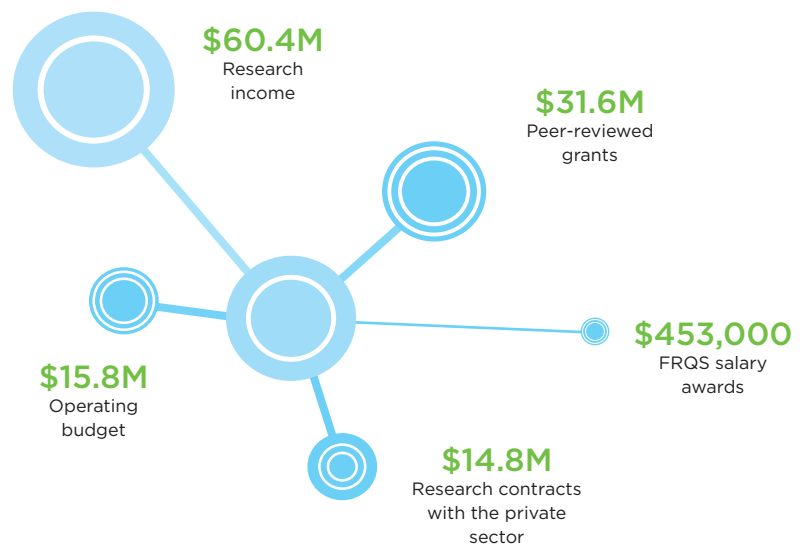
CARDIOMETABOLIC

NEUROSCIENCE

IMMUNOPATHOLOGY

IMAGING AND ENGINEERING

HEALTH INNOVATION AND EVALUATION HUB





AN ALIGNED VISION

Drawing on its hospital and university, the CRCHUM develops and uses conclusive data to transform health care and services across the province. To achieve this goal, our research centre counts on the excellence of its research teams, the quality of its collaborations, its ability to integrate and use any type of data (clinical, administrative, biological, etc.), and the collaborative involvement of its clinical teams, citizens and decision makers.

The CRCHUM is supported in its initiative by the Fondation du CHUM, which participates in financing infrastructure and equipment, helps train the upcoming high-calibre generation of scientists and encourages the transfer of the centre's unique knowledge and know-how. Funding from the Fondation enables the development of strategic initiatives such as the Centre for the Integration and Analysis of Medical Data (CITADEL).

A LIVELY SCIENTIFIC LIFE

Throughout the year, the CRCHUM offers a rich scientific program. Presented by renowned local and international researchers, the CRCHUM's talks showcase cutting-edge research in the CHUM's areas of focus. They are accredited by the Royal College of Physicians and Surgeons of Canada as continuing professional development activities. The same holds true for the MIAM (Moments de l'Intelligence Artificielle le Midi) artificial intelligence learning lunches talks that many researchers at the research centre take part in.

In November 2018, the CHUM announced the launch of the School of Artificial Intelligence in Health (SAIH). The SAIH allows the community to apply artificial intelligence to health care, measure its impacts for patients, teams and the health care system and share the knowledge discovered globally.

More than **550** researchers and investigators, including 144 regular researchers

765 publications

2,200 publications over the past 3 years

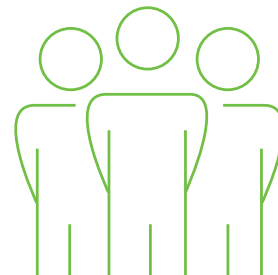
More than **460** graduate students

Nearly **200** employees supporting the research teams

13 Canada Research Chairs

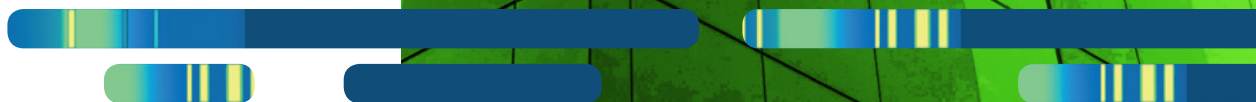
640 research staff members

18 University Chairs



CREATING POSITIVE IMPACTS FOR OUR PATIENTS

**AT THE CRCHUM, THE DEVELOPMENT OF
PATIENT-CENTRED RESEARCH IS A PRIORITY
FOR ACTION. THE KNOWLEDGE GENERATED
BY OUR RESEARCH ACTIVITY TRANSLATES
INTO DIRECT BENEFITS FOR CITIZENS. OUR
RESEARCH WORK PROVIDES A RANGE
OF HEALTH CARE AND INTERVENTION
SOLUTIONS FOR THE ENTIRE POPULATION.**



AREAS OF EXCELLENCE

MAJOR PATHOLOGIES

HEALTH CARE AND INTERVENTION SOLUTIONS

CANCER

BREAST, OVARIES
PROSTATE
LUNG

PERSONALIZED MEDICINE

COMBINATION THERAPIES

IMMUNOTHERAPY

CELL THERAPY

CARDIOMETABOLIC

TYPE 2 DIABETES
AND ITS COMPLICATIONS
HYPERTENSION
NEURAL PROCESSES
AND NUTRITION

PRECISION MEDICINE

PRECISION IMAGING

PREVENTION PROGRAMS

IMMUNOPATHOLOGY

TRANSPLANTATION
DIFFERENT TYPES OF HEPATITIS
HIV
AUTOIMMUNE DISEASES
OSTEOARTHRITIS

INCREASE IN ORGAN DONATIONS

VACCINES

PRECISION IMAGING

IMMUNOTHERAPY

NEUROSCIENCE

MULTIPLE SCLEROSIS
EPILEPSY
NEURODEGENERATIVE DISEASES
STROKE
ADDICTION/MENTAL HEALTH

EARLY DIAGNOSIS

IMMUNOTHERAPY

IMPROVING THE CARE TRAJECTORY

CROSS-CUTTING AREAS OF EXCELLENCE

IMAGING AND ENGINEERING

VIRTUAL AND AUGMENTED REALITY FOR ANALYZING AND IMPROVING
HUMAN MOVEMENT OR COMPUTER-ASSISTED SURGERY

3D PRINTING FOR RADIATION ONCOLOGY TREATMENTS

3D TISSUE PRINTING

ARTIFICIAL INTELLIGENCE

HEALTH INNOVATION AND EVALUATION HUB

CENTER FOR THE INTEGRATION AND ANALYSIS OF MEDICAL DATA (CITADEL)

GIVING PATIENT-PARTNERS A VOICE

The CRCHUM's patient-partner committee, made up of patients and researchers, guides the CRCHUM's management team as they introduce the patient-partner approach into their development priorities and research programs.

In the fall of 2018, this committee allowed two patient-partners to be appointed members of the CRCHUM's scientific committee. It also established an awareness campaign for patients and citizens to promote the importance of research and the research cycle process: knowledge generation, application and mobilization.

KEY CONTRIBUTIONS TO THE QUEBEC LIFE SCIENCES STRATEGY

To meet the standards of a world-class clinical research centre, in 2018 the CRCHUM established the Unit for Innovative Therapies (UIT) under the initiative of Dr. Rahima Jamal, a hemato-oncologist at the CHUM. The UIT allows patients whose treatment has failed to have access to new treatments and accelerate the development of such treatments. Developed in collaboration with several CRCHUM researchers, this project aims to strengthen the health care system, a priority established by the 2017-2027 Quebec Life Sciences Strategy. Major pharmaceutical companies are presently offering phase 1 clinical trials at the UIT. The unit also supports the CHUM's innovative clinical research programs by facilitating the development of trials initiated by our researcher-investigators.

Precision medicine is another priority component of this Strategy, not only for the province, but for the health care system and the public as well. The CITADEL (Center for the Integration and Analysis of Medical Data), an integral part of the CHUM and its research centre, has been a repository for the medical and administrative data of some 4 million patients treated at the CHUM since 1998. Accessing and using this data has been a valuable asset for both researchers and managers, who can analyze medical conditions, health care and services and recommend improvements that will benefit patients. Consisting of computer engineers, data scientists and biostatisticians, the CITADEL team facilitates data processing and analysis for nearly 60 projects currently underway.

On the strength of this infrastructure unrivalled elsewhere in Quebec, the CRCHUM received \$1.2M in funding from the Ministère de l'Économie et de l'Innovation to facilitate access to the clinical and administrative data of health institutions province-wide. This project involves Quebec's largest institutions (CHUM, MUHC, CHU de Québec, CHU de Sherbrooke, MHI, Quebec Heart and Lung Institute, etc.).

GLOBAL VISIBILITY

A world-class research centre, the CRCHUM produces high-quality knowledge output and mobilizes it widely across the scientific community, making it available to decision-makers and the public at large.

Here's a summary of 2018-2019, a year filled with discoveries and awards that echo our practical objective of playing a leading role in improving health care and promoting health.

DEVELOPING TALENTS

Since its founding, the CRCHUM has actively supported the development of successful research teams. With its dynamic environment that allows research groups in emerging and translational niche sectors to thrive, the CRCHUM is able to attract new research leaders and recruit the best students. In 2018, 10 regular researchers joined the CRCHUM: Chantal Bémeur (Cardiometabolic theme); Marie-Claude Bourgeois-Daigneault, Gerardo Ferbeyre and Dr. Philip Wong (Cancer theme); Sophie Petropoulos and Sabrina Anh-Tu Hoa (Immunopathology theme); Dr. François-Martin Carrier, Emmanuelle Duceppe and Dr. Brian James Potter (Health Innovation and Evaluation Hub theme), Mark Keezer (Health Innovation and Evaluation Hub and Neuroscience themes).

A well-known training facility, the CRCHUM welcomes an average of nearly 650 students per year (undergraduate, masters, doctoral and postdoctoral trainees). Each of our researchers supervises on average three to five students, destined to become future research leaders.

In 2017, to facilitate recruiting the best students, the CRCHUM introduced an Open House Day where masters, doctoral and postdoctoral students could meet our research teams and discover the unique characteristics of a research environment in an ultraspecialized hospital setting. In the past three years, more than 200 students have taken part in this event. The 2019 event was once again a success.

Held annually, the Student Congress also provides young scientists with a platform for presenting their research results and meeting world-class researchers. The 20th conference saw a record number of participants and featured 140 abstracts and 110 posters. The Datablitz session, a concept introduced this year in which students had three minutes to present their research results, was also highly appreciated.

DYNAMIC CLINICAL RESEARCH

833
projects
underway

163
new clinical
projects or trials

2018

APRIL

Rare brain disease in children: breakthrough in Rasmussen's encephalitis
Dr. Alexandre Prat

MAY

Shalini Lal appointed Canada Research Chair in Innovation and Technologies

Intestinal microbiota believed to influence response to anti-cancer immunotherapies
Dr. Bertrand Routy

Impact of the opioid crisis on the lives of people with chronic non-cancer pain in Quebec and British Columbia
Manon Choinière

JUNE

Development of a unique cancer immunotherapy program at the CHUM
Dr. Simon Turcotte, Dr. Rahima Jamal, Réjean Lapointe

The CRCHUM and its partners form a consortium to fight cancer

Restoring communication between neurons to slow down glaucoma
Adriana Di Polo

Appointment of Vincent Dumez to Pharmacare's Advisory Council

Dr. Fred Saad inducted as a knight into the Ordre national du Québec

DECEMBER

Editorial in the *British Medical Journal* by the Centre of Excellence on Partnership with Patients and the Public
Dr. Antoine Boivin and Alexandre Grégoire, patient-partner

Fight against HIV: patients with resistance provide a new molecular key
Dr. Cécile Tremblay

Career award given to Dr. Jean-Louis Chiasson by the Société Francophone du Diabète and Diabetes Québec

Interleukin IL-22, a new target to inhibit the progression of liver disease
Naglaa Shoukry

A tool to identify adolescents at risk of smoking developed at the CRCHUM
Marie-Pierre Sylvestre, Jennifer O'Loughlin, Nancy Hanusaik

OCTOBER

2019

JANUARY

Claude Bernard Lyon 1 University (France) awards the title of *Doctor honoris causa* to Jacques A. de Guise

CRCHUM Awards of Excellence honouring health research

Career
Dr. Diane Provencher

Young Researcher
Dr. An Tang

Scientific Contribution of the Year
Adriana Di Polo

FEBRUARY

Deep neural networks identify tumours
Samuel Kadoury, Dr. An Tang

The Paul-Lupien and Jean-Davignon Founders' Award is given to Marc Prentki in recognition of his long-standing career

MARCH

Jean-Louis Denis inducted as a Fellow in the British Academy of Social Sciences

Dr. Saima Hassan receives the Emerging Science Award for her commitment to fighting breast cancer (Fonds de recherche Québec-Santé Career Award program)

Using anti-cancer immunotherapy to fight HIV
Nicolas Chomont and Rémi Fromentin

Designing better embryos: breakthrough in the field of infertility
Greg FitzHarris

Nathalie Arbour appointed Claude-Bertrand Chair in neurosurgery at the Université de Montréal

PROMOTING INNOVATION AND VALORIZING KNOWLEDGE

THE CRCHUM GENERATES KNOWLEDGE AND IMPLEMENTS AND SUPPORTS PROJECTS THAT HELP TRANSFORM PATIENT CARE BY MAKING USE OF THE BEST AND MOST CURRENT SCIENTIFIC DATA.

INNOVE-ACTION: REINVENT HEALTHCARE

A world-class hospital, the CHUM is redefining the hospital experience. In collaboration with CHUM management teams, the Research management team launched InnoVe-Action, a new conference-style event dedicated to innovation that brings together researchers, students, industry partners, health professionals, decision makers, managers and patients. The first edition in 2018 saw more than 1,000 attendees over 3 days and featured a varied program consisting of talks and themed scientific workshops, presentations of industry solutions, student posters, stands, satellite symposia, B2B meetings and talks open to the public.



VIA CHUM BEACHHEAD™: A FRAMEWORK FOR YOUR IDEAS

At the CHUM, as elsewhere, developments in artificial intelligence (AI) have had a profound impact on medical practice. Rather than viewing AI as a threat, the CHUM has opted to make the most of it and become the first world-class AI-driven hospital.

Our VIA CHUM Beachhead™ initiative provides a connection between the CHUM's clinical expertise and data science (AI) in real-life care settings to drive innovation with the help of medical and digital technologies. By connecting innovators, AI experts and clinical experts, the CRCHUM is supporting its clients' innovations and bringing them to fruition.

The Beachhead™ program is one of the core programs of the Centre of Excellence for Commercialization and Research (MEDTEQ). Its goal is to establish partnerships between a clinical centre of excellence and businesses to accelerate the adoption of the best medical technologies for the benefit of patients and health systems in Canada.



VALORIZATION

- 8 spinoff companies active in the following areas:
 - Medical technology
 - Biomaterials
 - Personalized medicine
 - Metabolic diseases
 - Virtual nurse platform
- 38 active patents
- 33 pending patent applications
- 19 active business agreements
- 10 invention disclosure statements



