Annual report 2023-2024

10 YEARS TOGETHER: A COMMUNITY TO (RE)DISCOVER

CRCHUM

RESEARCH CENTRE

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The annual report for the CHUM Research Centre is published by the Research and Innovation Division.

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Gerardo Ferbeyre (Cancer Research Theme)

Gareth Lim and Thierry Alquier (Cardiometabolic Research Theme)

Dr. François Martin Carrier, Line Beaudet and Lise Gauvin (Health Innovation and Evaluation Hub)

Dr. Cynthia Ménard and Dr. Gilles Soulez (Imaging and Engineering Research Theme)

Petronela Ancuta and Emmanuelle Brochiero (Immunopathology Research Theme)

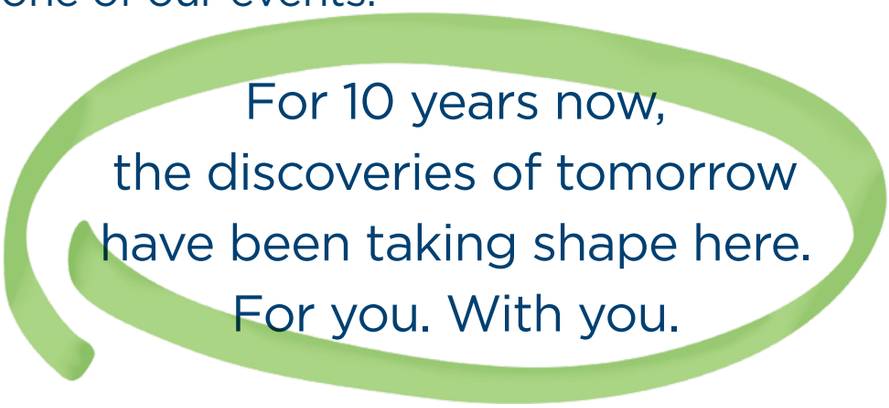
Dr. Amal Abdel Baki and Nathalie Arbour (Neuroscience Research Theme)

10 years already! And as always, dare to look beyond the horizon

On September 30, 2013, the completion of the two modern and bright buildings of the CHUM Research Centre (CRCHUM) marked the first step in the construction of the CHUM. Thus, it facilitated the presence of all research teams on the same site.

Since then, behind the scenes at the CRCHUM, a rich, international and diverse community has been working, driven by the desire to build a healthy future. For the entire province of Quebec.

If science advances through small and big ideas, it is born above all from human collaborations, which sometimes begin after an unexpected encounter in the hallway or during one of our events.



This year, we have chosen to highlight the extraordinary career of researcher Line Beaudet and to emphasize individuals who exemplify excellence in some of our research areas.

Developing advanced treatments and interventions is what CRCHUM research teams work on every day. Often in the shadows, they go beyond the horizon to make a difference in people's lives.

Consider the optimization of the implementation of early intervention programs for first psychotic episodes led by Dr. Amal Abdel-Baki through the SARPEP project, the fundamental research on HIV by Petronela Ancuta or the new approaches in interventional radio-oncology by Dr. Cynthia Ménard.

Not to mention the research programs of Gerardo Ferbeyre on cellular senescence and cancer, Gareth Lim on diabetes and Dr. François Martin Carrier on transfusion medicine.

As you read, (re)discover our rich community, made up of individuals who are shaping the future of health research in Canada and around the world, one project at a time.

Dr. Vincent Poitout
Director of Research and Innovation at the CHUM
Scientific Director of the CRCHUM

What a journey it’s been over the past decade!

It has been 10 years since the teams at the CHUM Research Centre (CRCHUM) were brought together under one roof, with state-of-the-art infrastructure. Ten years during which the driving forces of basic research, clinical research and population health research have come together to enable incredible innovations and promising treatments to emerge. Ten years in which the future of health has been built here. What a journey it’s been over the past decade!

The CRCHUM teams have approached 2023 and 2024 with the same boldness that has guided them from the very beginning, paving the way for significant preventive, diagnostic and therapeutic advancements for all Quebecers. You will see in this report that the past year has once again underlined the importance of pushing the boundaries of research to better understand, improve, prevent, detect, cure and treat.

Hailing from diverse backgrounds, members of the CRCHUM community are ready to break down barriers to tackle the health challenges before us and create hope for patients and their loved ones. Behind each of these people, there is an impressive willingness to contribute to something greater than themselves and a dedication worthy of all our recognition.

To each of them, I say: thank you for being with us.

May this report make you realize the extent of their commitment!

Marie-Eve Desrosiers
Interim Chief Executive Officer of the CHUM

10 years together: A community to (re)discover

September 30, 2013 Management at the Centre hospitalier de l'Université de Montréal (CHUM) officially received the keys to the first two pavilions housing the CHUM Research Centre (CRCHUM), the Centre d'apprentissage et de simulation and the administrative offices.

This historic step in the construction of the hospital complex that now houses the CHUM has left its mark on the minds of thousands of people: both those who work there reinventing health care and those who pass by these modern, light-filled premises in the heart of downtown Montreal.

“The positive impact of moving all our teams—scattered over six different sites before 2013—to a single location has been significant. It has allowed us to get closer to the entire CHUM community,” states Dr. Vincent Poitout, Director of Research and Innovation at the CHUM.

“This proximity to technology core facilities and individuals has enabled cross-fertilization. The move has been a tremendous catalyst for collaboration and innovation.” And this is still true to this day.

Together, under one roof for 10 years, the CRCHUM community has retained this irrepressible desire to surpass itself and act as a true creator of positive impacts in the lives of patients.

Learn more

Through our series of web publications called ***10 years together,*** discover the research teams’ successes, the scientific core facilities’ technological advances, the faces of the next generation and the events that punctuate scientific life at the CRCHUM.

Further reading: CHUMAGAZINE Special 10 years

The CRCHUM at a glance

The CRCHUM is Université de Montréal's largest biomedical and health care research centre. It's one of the largest and most modern centres in Canada.

Located in the heart of Montreal, the CRCHUM is a hub of creation, knowledge generation and training.

Under its roof, you'll find, coexisting in harmony, basic research, clinical research and population health research, which are approached through the six research themes:

Cancer

Cardiometabolics

Immunopathology

Neuroscience

Imaging and Engineering

Health Innovation and Evaluation Hub

Over
150 M$
in research revenues

DYNAMIC CLINICAL AND EPIDEMIOLOGICAL RESEARCH

339
new clinical or epidemiological trials

19 **core facilities**
to support research

In 2023-2024, nine regular researchers have strengthened the ranks of the CRCHUM and will participate in developing emerging and translational research niches, as well as the influence of the research centre on a Canadian and global scale.

A warm welcome to Dr. Jean-Marc Bourque, Nathalie Clavel, Dr. Stéphanie Forté, Claudie Laprise, Dr. Jean-Charles Pasquier and Dr. Jesse Chong Shen (Health Innovation); Dr. Sami Obaid (Neuroscience); Dr. Arielle Elkrief (Cancer) and Arthur Lalonde (Imaging and Engineering).

160 regular researchers

335 investigators

110 postdoctoral fellows

62 researchers—health professionals

13 Canada Research **Chairs**

418 graduate and post-graduate students

1272 peer-reviewed **publications**

23 Philanthropic **Chairs**

1043 research and administrative staff

Data as at March 31, 2024 (fiscal year 2023-2024)

Tailored support

Valuing research in academia means giving it a value other than what it already has. It means making the knowledge, skills and results of research operational or marketable.

At the CRCHUM, the Technology Transfer Office raises awareness about intellectual property in the scientific community and supports the community throughout the transfer process.

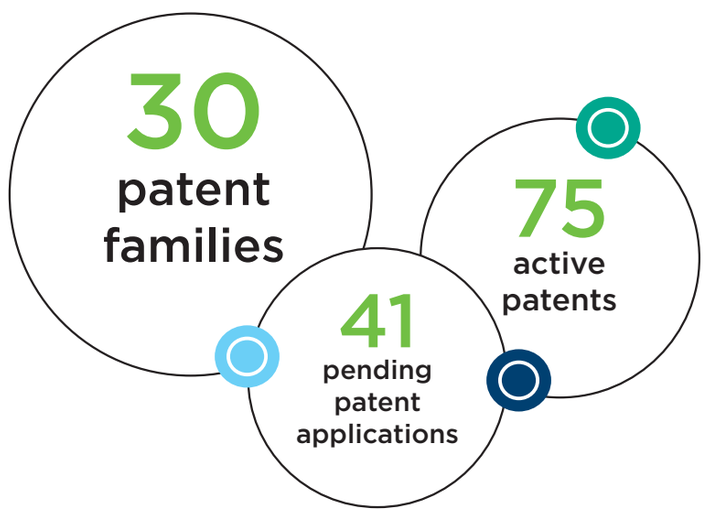
By offering strategic advice, it accelerates the progress and impact of science, contributes to the social and economic development of Quebec and Canada, and thus maintains the country's technological competitiveness.

15 **active spin-off companies, including in the following fields:**

- **Digital health**
- **Contract research**
  - Rare diseases
  - Oncology
- **Diagnostics**
  - Oncology
  - Fertility
- **Molecule targeting**
  - Rare diseases
  - Oncology
  - Diabetes and metabolic diseases
  - Regenerative medicine and transplantation
- **Personalized medicine**
  - Type 2 diabetes
  - Oncology
- **Biomechanics**
- **Biomaterials**

+ than 90 active inventors

21 active business agreements



Data as at March 31, 2024 (fiscal year 2023-2024)

10 years of research

Through a decade of work, incredible scientific advances, fruitful collaborations and promising treatments have emerged at the CRCHUM.

Here are three notable examples.

Lung cancer: a less invasive surgical intervention

Dr. Moishe Liberman has paved the way for the extensive use of thoracoscopic lobectomy. This is a video-assisted thoracic operation, combined with ultrasonic sealing of the pulmonary artery. This surgical technique allows for a faster recovery.

Treating diabetes more effectively

The team led by Marc Prentki has opened up new therapeutic avenues to treat obesity and diabetes by discovering a glucose detoxification molecule: the enzyme G3PP.

Hepatitis C: two exceptional investigators

Hepatitis C virus (HCV) infection affects 58 million people worldwide. More than 95% of infected people can be cured by antiviral medications, but access to diagnosis and treatment remains limited.

At the forefront of this public health battle is Naglaa Shoukry. Since 2015, she has directed the National Hepatitis C Collaborative Network. This pan-Canadian group seeks to improve the health of people living with hepatitis C and prevent new infections.

She collaborates with Dr. Julie Bruneau, one of the first doctors to treat hepatitis C in drug users. Dr. Bruneau is one of the three initiators of a large multidisciplinary project to make Montreal the first city in North America to eradicate HCV.

Browse our ***impact research panorama*** to learn more about research in the areas of HIV, the microbiome and multiple sclerosis.

Leader in precision health care

Optimizing the health of each person by accounting for the variability of their genetic heritage, environment and lifestyle: this is the promise of precision health care.

Within 10 years, it will be established in a set of sectors in the CHUM, relying in particular on the infrastructures of CITADEL, the CHUM's Centre for the Integration and Analysis of Medical Data, where a team of 24 high-level specialists (in data architecture, data sciences, bioinformatics, biostatistics, medicine) work.

Since 2023, the CHUM and the CRCHUM have been developing a Precision Health Strategy. The launch of the ***Centre d'innovation en santé de précision*** in April 2024 was part of this strategy.

Through close cooperation between the clinical and research communities, the Centre will support CHUM teams in the development and adoption of new approaches to precision health. The population will benefit from these scientific advancements.

CHUM Foundation: 10 years of supporting bold research

The CHUM Foundation provides a vital source of funding for the CHUM and its research centre (CRCHUM).

For 10 years now, the Foundation has contributed $43 million to accelerate the research efforts of the CRCHUM community, encourage innovation and push the boundaries of medicine.

This year, it launched its first major campaign since the creation of the new CHUM. Its goal: raise $200M to *move faster than the disease*.

> The donations raised have a leverage effect for researchers, multiplying the initial contributions by four to ten times.

Here are some innovative initiatives supported by the Foundation and aimed at advancing precision health.

- A collaboration with ANGANY Inc. and the CRCHUM Cancer Research Theme will empower research staff to explore vaccination as a revolutionary cancer treatment using immunotherapy tools.
- An unprecedented partnership between Cardio F and pharmacies affiliated with Pharmaprix has given rise to an initiative to prevent and better manage the risks associated with postpartum cardiovascular complications, thanks to an innovative proximity monitoring model.
- Researcher Nicole Leclerc's work on progressive supranuclear palsy (PSP) aims to identify new biomarkers in order to develop personalized treatments and, thus, to stem the progression of neurodegeneration.
- Dr. Noiseux and his team wish to revolutionize heart transplants by implementing an innovative technique and pharmacological treatment. This model aspires to increase the number of viable organs for a transplant following a cardiocirculatory death.
- A new Leica STELLARIS 8 confocal microscope, with ultra-sensitive detectors and powerful algorithms, was acquired to enable major advances in various fields, from multiple sclerosis to embryogenesis.

To support the training, development and improvement of CRCHUM staff, more than $3.8M has been awarded to fund 24 seed grants and 128 fellowships, helping to attract the world's top talent.

The Foundation is proud to be an ally to the CRCHUM, which brings together some of the most ambitious and daring scientific teams in North America.

CHUM
FONDATION

10 years on the cutting edge

CRCHUM researchers are committed to transforming scientific advances into advances in human health.

To achieve this, research teams can count on the expertise of specialists from 19 core facilities, which have seen their number almost double in 10 years (10 core facilities in 2013).

To date, the CRCHUM remains the scientific research institution that offers the largest number of core facilities in Quebec.

Seven of them are unique:

- ATiM
- CITADEL
- Experimental imaging
- Microfluidics
- Public patient partnerships in research
- Small animal phenotyping and imaging
- Radiochemistry and cyclotron

Microfluidics: miniature laboratories

Unique in the world, microfluidic device technology was developed and refined over 10 years by the teams of researchers Anne-Marie Mes-Masson and Thomas Gervais.

Mini laboratories held in the palm of one hand, make it possible, among other things, to test, observe and predict, in a controlled environment, the response to treatment of cancer samples from patients (through a tumour biopsy, for example). All with a shorter analysis time!

Exceptional character, excellent results

In Quebec, the CRCHUM is the only research centre to offer, through their core facilities:

- An equipment replacement program, which ensures it provides the most advanced and high-performance technologies;
- A research and development program, which allows it to adapt to the emergence of new technologies and to improve the services offered or the quality of an existing service.

For the third consecutive year, the core facilities' activities are increasing, which is characterized by a revenue of $6.7M, the highest in Quebec. This represents an increase of almost 20% compared to the previous year.

Some news from CITADEL

To date, more than 400 research projects have been conducted to improve population health.

The CHUM teams now want to go even further! They want to combine clinical data with phenomenal amounts of "omics" data, that is, biological and environmental data obtained through new technologies.

Through this evolution, CITADEL's scientific team will help to better predict and prevent diseases, establish more accurate and early diagnoses and offer even more personalized health care.

Using its ability to organize and analyze big data, artificial intelligence has the potential to transform health care and health services.

But, for example, how can we guarantee the security and performance of an algorithmic model from one hospital environment to another?

This question was addressed at the Symposium *Tracer le futur de la santé : transformer les soins par la puissance des données* held at the CHUM in November 2023, on the 5th anniversary of CITADEL.

To find out more about the services we offer, visit our ***Core facilities and services*** section.

Dare to succeed

In 10 years, more than 2,000 students and postdoctoral fellows have set foot in the CRCHUM, an internationally recognized multilingual training environment with more than 20 languages spoken.

Whether in population health research offices or one of the 75 basic and clinical research laboratories, the teams of the CRCHUM community continue to welcome a new generation of scientists without borders, those shaping the future of research. Here we recognize a few people who trained at the CRCHUM, who have forged their own path and who have had the audacity to succeed over the last decade.

Imaging and engineering

Before becoming Canada Research Chair in Emerging Applications of Spectral Computed Tomography, Hugo Bouchard, a researcher since 2017, cut his teeth on Gilles Beaudoin's team at the CHUM.

Neuroscience

Researchers since 2020, Éric Samarut and Élie Bou Assi first entered the CRCHUM as postdoctoral fellows, in the teams of Pierre Drapeau (2014) and Dr. Dang Khoa Nguyen (2017), respectively.

Éric Samarut is exploring a new area of research using zebrafish: the functional genomics of rare neurological and metabolic disorders. As for Élie Bou Assi, he is continuing his work on detecting and predicting epileptic seizures, those electrical brainstorms.

To gauge the vitality of the next generation of scientists, read our article ***Researchers of tomorrow*** or explore our series of publications ***Faces of research***.

A stimulating scientific life

The CRCHUM is the scene of a dynamic scientific life that is rich and always in motion. Many events and conferences take place at the Centre every year, featuring internationally renowned scientific personalities.

Scientific Days

The CRCHUM Scientific Days has been the flagship event of the organization's scientific outreach since 2010 and each edition is built around conferences featuring renowned researchers, giving the entire community the opportunity to hear about the latest scientific advances.

Between 2013 and 2023, the research centre had the pleasure of welcoming several Nobel laureates (Andrew Z. Fire, Jules Hoffmann, Dr. Robert Lefkowitz and Sir Peter J. Ratcliffe) and illustrious scientists (Dr. Dan H. Barouch, Dr. Pierre Corvol, Fabiola Gianotti, Dr. Axel Kahn and Mona Nemer).

On October 25 and 26, 2023, an exceptional program celebrated 10 years of research activities under one roof.

More than 400 people attended the lectures given by 6 scientists invited by the heads of the 6 CRCHUM research themes:

- Dr. Daniel J. Drucker (Cardiometabolic Research Theme)
- Margaret McCarthy (Neuroscience Research Theme)
- Dr. François Bénard (Imaging and Engineering Research Theme)
- Dr. Stéphanie Lheureux (Cancer Research Theme)
- Dr. Viviana Simon (Immunopathology Research Theme)
- And Dr. Frederick Lewis Altice (Health Innovation and Evaluation Hub Research Theme)

In addition to the plenary lectures, nine sessions, built around discussions and exchanges, allowed the public to learn more about new research trends and their impact on health.

In addition to the plenary lectures, nine sessions, built around discussions and exchanges, allowed the public to learn more about new research trends and their impact on health.

CRCHUM Student, Postdoctoral fellows and Resident Convention

This year, the event was, once again, a resounding success, and was central to knowledge sharing within the CRCHUM community.

Nearly 350 people participated and were able to appreciate the vast diversity of research themes through oral presentations and scientific posters.

For its first edition, the *Vue sur ma science* scientific photography competition, held during the congress, highlighted the talent of the student and postdoctoral community.

During one of the two special panels, the public was given a behind-the-scenes look at science journalism at Radio-Canada thanks to the presence of Matthieu Dugal, host of the radio show *Moteur de recherche,* and one of his recent guests, Dr. Roy Hajjar, clinical researcher at the CRCHUM.

Want to find out more about CRCHUM events? Check out the ***schedule***.

Prostate cancer: tracked and traced

Dr. Cynthia Ménard

IMAGING AND ENGINEERING RESEARCH THEME

Head of the Department of Radiation Oncology since 2020, Dr. Cynthia Ménard draws inspiration from mentors she met earlier in her career at the National Institute of Health and Princess Margaret Hospital in Toronto to share her passion for radiation oncology and her sense of commitment to patients in order to elevate health practices. “I aspire to change things by pushing boundaries. Going with the status quo is not enough, because there is always a way to do better!”

This philosophy has always accompanied her in her research since she joined the CRCHUM in 2015. And her desire to innovate has borne fruit, since the last year has been marked by success for her laboratory.

A successful step

First, Dr. Ménard's team and its partners obtained promising results from her phase 2 randomized controlled trial that started in 2018, which aimed to evaluate the effect of intensified radiotherapy guided by a radiotracer and positron emission tomography (PET) on the condition of patients with prostate cancer.

> "We realized that cancer was sometimes more prominent than traditional imaging allowed us to guess. We therefore wanted to demonstrate that improving the quality of radiotherapy with a more efficient imaging tool makes it possible to better define the extent of the cancer and, consequently, to intensify radiotherapy and improve the patient's condition."
>
> *— Dr. Cynthia Ménard*

The promising findings, published in the *International Journal of Radiation Oncology*Biology*Physics* in July 2023, indicate that patients benefited from this approach in terms of toxicity and disease intensification. The latest results were presented at the European Association of Urology congress.

Toward a health care revolution

This phase 2 trial enabled Dr. Ménard to win $3M in funding in 2020 from the Canadian Cancer Society and the Movember Foundation to conduct a national phase 3 clinical trial. They completed the enrollment of 800 patients from 19 health facilities across Canada last January after three years of work.

This large-scale study will confirm whether the new therapy approach is superior to current medical protocols and evaluate whether the benefits of the treatment outweigh any possible side effects. It will also provide valuable data to determine whether patients' quality of life improves in the long run.

"It's a never-before-seen large-scale study on this subject that will allow hospitals around the world to adapt their treatments," said Dr. Ménard.

Interdisciplinarity in service of innovation

Studies of this scope are obviously not done in a vacuum; they involve the synergy of several collaborators, especially the radiotherapy, nuclear medicine, urology and oncology research units, in addition to the many partners in Canadian academic centres.

A little anecdote: when the CRCHUM moved to its new premises in 2014, Dr. Ménard was assigned an office next to a radiochemist, Jean Dasilva, who is passionate about the development of tracers for PET imaging. Chance led them to collaborate to develop a tracer, which she used in her research in radiation oncology.

“The goal of the Imaging and Engineering Research Theme is to connect researchers with complementary fields of expertise, even if they come from different fields, so that they can collaborate on projects, and that’s what happened,” she said. This new tracer was certainly a catalyst for her subsequent research!

Research Theme Highlights

Imaging and Engineering Research Theme

April 2023

Dr. An Tang receives the prestigious title of Fellow of the Canadian Association of Radiologists at its annual conference in recognition of the excellence of his practice.

June 2023

Dr. Martin Girard wins a grant of $244,375 from the Natural Sciences and Engineering Research Council of Canada (NSERC) for his project to improve mechanical ventilation.

July 2023

CIHR awards $726,750 to Guy Cloutier’s team and $401,625 to Dr. Martin Girard and Dr. Michaël Chassé’s teams for their imaging and engineering projects.

Dr. Houda Bahig receives a $225,000 grant from the Marathon of Hope Cancer Centres Network for her work to advance the treatment of patients with head or neck cancer.

October 2023

Dr. Gilles Soulez is elected as an honorary member of the French Society of Radiology for his pioneering role in the field.

January 2024

The CRCHUM management awards the Bâtisseur Award to researcher Jacques de Guise for his invaluable contribution to the field of medical imaging and for his unifying leadership.

February 2024

The team of Dr. An Tang and Guy Cloutier as well as that of Dr. Daniel von Renteln each receive a grant totalling more than $1M from CIHR.

Radiologist Gilles Soulez and his team of Canadian researchers develop a novel approach to treat liver tumours using magnet-guided microrobots in an MRI device.

A protein with a key role in type 2 diabetes

Gareth Lim

CARDIOMETABOLIC RESEARCH THEME

We know that type 2 diabetes is an increasingly common health problem in the country. More than three million Canadians were diagnosed with diabetes in 2022, of which 9 out of 10 cases were type 2. To better treat this metabolic disease and improve the quality of life of patients, we must first shed light on the mechanisms leading to its onset.

Gareth Lim, holder of the Canada Research Chair in Adipocyte Development, has always been fascinated with this topic.

His research team focuses on energy homeostasis and glucose regulation in adipocytes, which are the cells that store fat, also known as *fat cells or adipose cells.*

Deciphering molecular mechanisms

More specifically, Lim studies the role of molecular scaffolding proteins, particularly the 14-3-3 protein family, in the function, evolution and survival of adipocytes and pancreatic beta cells, which secrete insulin, the hormone that activates glucose to provide energy to the body.

What does this have to do with type 2 diabetes? These two types of cells are involved in the onset of the disease as well as in the development of obesity, which is itself a risk factor for type 2 diabetes.

“Over the past year, we have tried to determine how the 14-3-3 zeta protein controls or influences insulin secretion in the beta cell and what the molecular mechanisms are that regulate the development of adipocytes,” says Lim. “We take advantage of the interactome—the map of all interactions between proteins and cells in an organism—to identify new players in the development of an adipocyte.”

In conjunction with this colossal task, Lim and his team are conducting drug repurposing studies to assess whether 14-3-3 zeta could treat colorectal cancer.

Synergy with CRCHUM core facilities

Since Lim’s laboratory uses different strains of mice to test his hypotheses, his team relies on several innovative core facilities at the CRCHUM, starting with the state-of-the-art animal facility, which holds a Certificate of Good Animal Practice from the Canadian Council on Animal Care. The small animal phenotyping and imaging core facility allows them to understand what happens when the gene responsible for the production of the 14-3-3

zeta protein is deleted or overexpressed, for example, if there is an impact on the quantity of fat cells and the carbohydrate metabolism in mice.

His team also uses state-of-the-art equipment from the cytometry, cellular imaging, molecular pathology and cellular physiology core facilities for cellular work, accelerating the timeline of their research. Additionally, the transgenesis and animal modelling core facilities prove invaluable for the derivation of mouse strains, as well as freezing and storing sperm and embryos for lineages that will be studied later.

Inspiring the scientists of tomorrow

In addition to advancing knowledge on diabetes and obesity with the goal of developing more effective treatments, Lim is very pleased to help students transitioning through his lab to progress in their careers, so that they can, in turn, contribute to scientific advancements.

> "Witnessing my interns' excitement as they make discoveries, big or small, rekindles the spark in me that originally led me to research! I have always considered myself very privileged to be a researcher, because very few professions allow a person to pursue their passions and share them with others."
>
> *— Gareth Lim*

Research Theme Highlights

Cardiometabolic Research Theme

May 2023

Advances in the fight against diabetes: Guy Rutter and researchers in Europe, Canada and America demonstrate that the NogoR protein could help personalize treatments.

July 2023

Marc Prentki's team receives a grant of over $1M over 5 years from CIHR for their research on senescence and healthy ageing.

August 2023

Guy Rutter's laboratory receives $1.75M from the CIHR-JDRF Partnership to Defeat Diabetes.

October 2023

In an opinion piece published in *Nature Neuroscience,* Ciaran Murphy-Royal and his American colleagues argue that astrocytes are active partners that help neurons fulfill their functions.

December 2023

The *Journal of Neuroinflammation* publishes a study by Stephanie Fulton and Thierry Alquier's teams, in collaboration with the Neuroscience Research Theme, about the role of an omega-3 fatty acid receptor in neuroinflammation.

January 2024

Dr. Pavel Hamet and Johanne Tremblay receive $12.8M in funding from Génome Québec to establish a new score aimed at improving the prognosis of patients with type 2 diabetes.

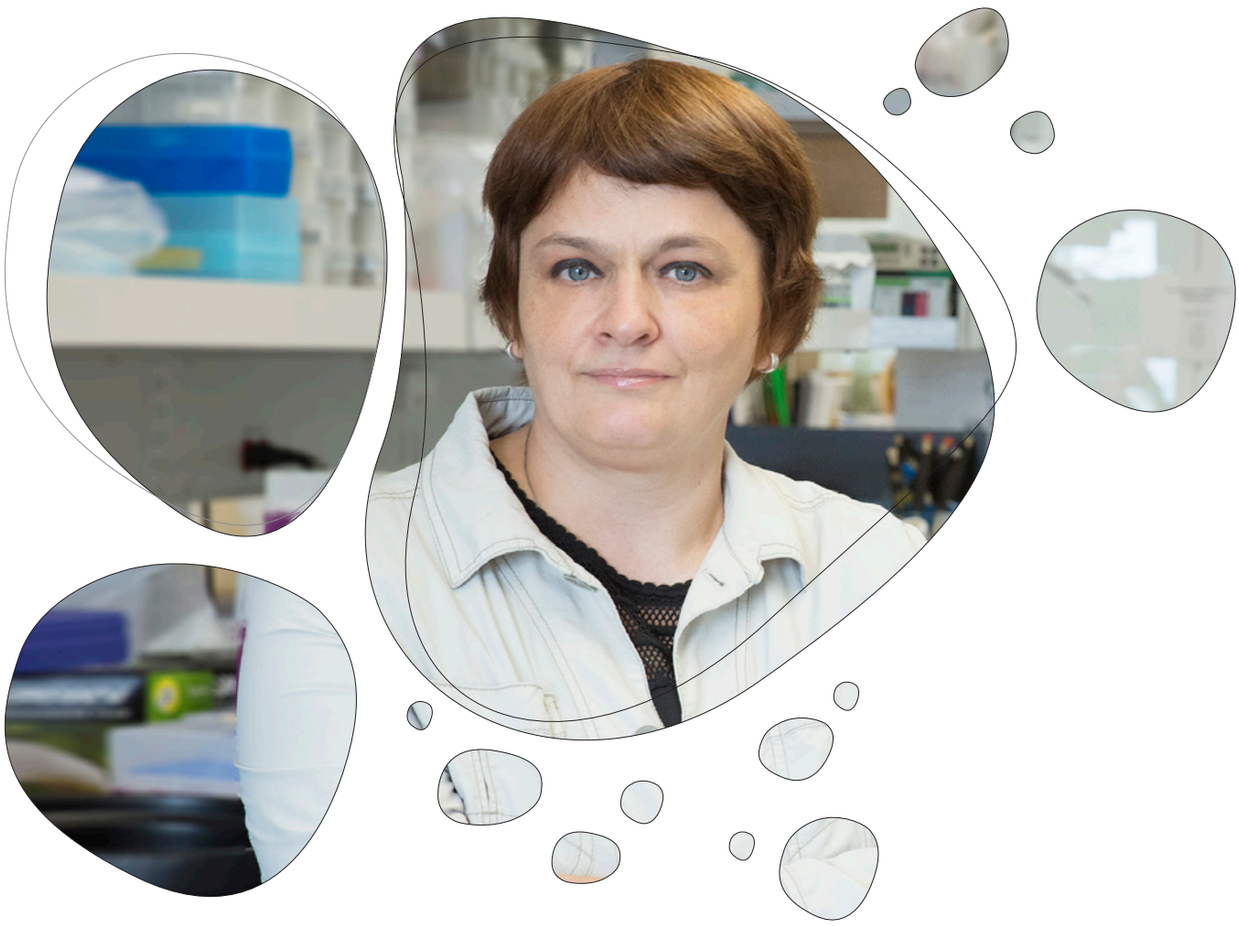
February 2024

The CIHR awards funding to two teams from the research theme: $933,300 to Christopher Rose's team and $100,000 to Naglaa Shoukry's team.

March 2024

A team including scientists from the CHUM and CHUS research centres receives $16.4 million from the Canada Foundation for Innovation, the Quebec government and several partners for their research on the early detection of type 2 diabetes.sur la détection précoce du diabète de type 2.

Outwitting HIV



Petronela Ancuta

IMMUNOPATHOLOGY RESEARCH THEME

Petronela Ancuta is passionate about immunology and realized one of her dreams by becoming Director of the Cell Migration and HIV Pathogenesis laboratory at the CRCHUM in 2006. Principal investigator of CIHR's Canadian HIV Cure Enterprise (CanCURE) since 2014, she aims to deepen the scientific understanding of this virus to improve the quality of life of people living with it.

Although HIV can now be controlled by antiretroviral therapy, its persistence in the body of infected people continues to lead to chronic inflammation, which causes several health problems such as neurodegeneration, cardiovascular diseases and osteoporosis.

Identifying the molecules involved

Ancuta and her team succeeded a few years ago in bringing to light the role of TH17 lymphocytes, mainly located in the intestine, in viral persistence in people living with HIV and receiving antiretroviral therapy.

After demonstrating that TH17 cells are very permissive to HIV, she looked at the factors that lead to their infection. Her laboratory then discovered that a molecule facilitates the replication of the virus: the RORC2 protein, for which there are already inhibitors, developed for the purpose of treating autoimmune diseases. Her team also proved that the aryl hydrocarbon receptor (AhR) plays a crucial role in the latency of the virus, paving the way for new therapeutic strategies.

Following these major advances, and in partnership with the teams of Dr. Eli Haddad, clinician scientist at the CHU Sainte-Justine Research Center, and Eric Cohen, researcher at the Montreal Clinical Research Institute (IRCM) and director of CanCURE, Ancuta carried out a preclinical study on humanized mice—mice that contain human tissue and are carriers of HIV—to test the antiviral effectiveness of RORC2 inhibitors.

Circadian rhythm under the microscope

By studying how to counteract HIV, Ancuta's team also found that TH17 cells contained overexpressed molecules involved in the regulation of the immunity clock. "Body activities are governed by a central clock and

peripheral clocks, and the immune system also has rhythmic activity, so we find different cells in the blood depending on the time of day. This is called chrono-immunology," Ancuta explains.

It seems that a deregulation of this clock would have a negative impact in people infected with HIV. With funding from CIHR, her laboratory has therefore started a study to assess the presence of certain immune cells in the blood of infected people throughout the day.

Essential collaborations

As part of her projects on cellular immunity mechanisms, Petronela Ancuta's laboratory uses the flow cytometry core facility located inside a biosafety level 3 laboratory. This state-of-the-art equipment will be used, among other things, to study fetal cells from the placenta of people living with HIV in order to understand its impact on children, even if they are not infected with HIV due to antiretroviral treatment.

"I have had the opportunity to meet remarkable people living with the virus and to understand how the disease affects their daily lives. These people are often stigmatized and isolated, even in Canada, and I hope to make a difference in their lives."

— Petronela Ancuta

Research Theme Highlights

Immunopathology Research Theme

April 2023

Dr. Simon Grandjean Lapierre receives a grant from the AIDS and Infectious Diseases Network to better understand the epidemiology of tuberculosis in Quebec.

Nathalie Grandvaux's team reveals the presence of infectious particles in air samples collected from rooms of patients with COVID-19.

May 2023

Dr. Marie-Josée Hébert receives the insignia of the Ordre de Montréal as a knight for her remarkable contribution to the development and reputation of Montreal.

Dr. Robert Battat, Dr. Héloïse Cardinal and Dr. Marie-Chantal Fortin receive a career grant awarded as part of the Fonds de recherche du Québec en santé (FRQS) scholarship program.

September 2023

Researchers Naglaa Shoukry and Sarah Kimmins receive a total of nearly $2M from the John R. Evans Leaders Fund for their research.

A CanCure team, led by CRCHUM researcher Nicolas Chomont, establishes that HIV reservoirs are concentrated in the spleen and lymph nodes, and that they can travel in the human body.

October 2023

CRCHUM researcher Sarah Kimmins participates in the report of 25 international experts on male infertility.

December 2023

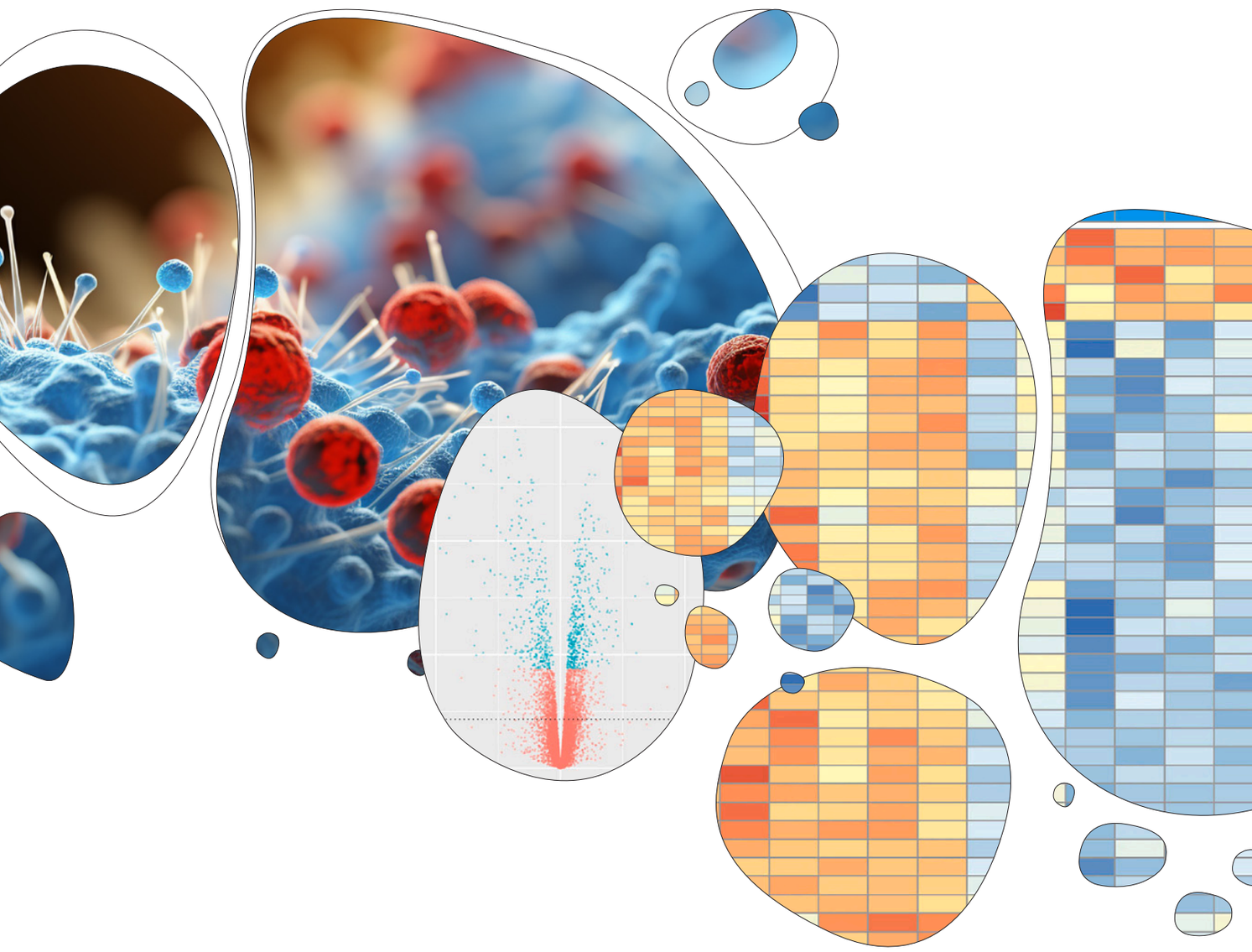
A study by Mehdi Benlarbi, a student in Andrés Finzi's laboratory, demonstrates the link between inflammation in people living with HIV and the blood level of the protein gp120.

January 2024

Sarah Kimmins and colleagues from Canada, South Africa and Denmark establish that men's exposure to DDT influences their spermatozoa and the health of their children.

February 2024

Petronela Ancuta receives a $100,000 grant from CIHR for her work on AhR.



Making cancer bite the dust

Gerardo Ferbeyre

CANCER RESEARCH THEME

When he arrived at the CRCHUM in 2018, Gerardo Ferbeyre brought his experience in basic research on the body's protection mechanisms against cancer and his unique point of view as a biochemist. He was attracted by the possibility of seeing how his work could strengthen clinical research and make it closer to the reality of patients.

He was recruited to the CRCHUM by the Cancer Research Theme under the supervision of Anne-Marie Mes-Masson and contributed to important discoveries on the metabolism of cancer cells. Today he is the chair-holder of the CIBC Chair in Causes of Breast Cancer at Université de Montréal and head of the Cancer Research Theme since May 1, 2024. He's continuing his research on cellular senescence—a dormant state in which cells stop dividing—and anti-cancer therapies.

A promising treatment

In August 2023, Ferbeyre was awarded a $2.4 million grant from the Terry Fox Research Institute to conduct research aimed at preventing resistance to chemotherapy by targeting senescent cells, which seem to evade treatment and contribute to the recurrence of cancers, particularly of the prostate and pancreas.

> The innovative method developed by him and his colleagues, called "one-two punch," consists of inducing the senescence of cancer cells—their premature aging—and eradicating them.

The laboratory's basic research is first carried out using animals from the CRCHUM animal facility. The scientists also use the CRCHUM biobanking core facility to obtain human cancer tissue samples, as well as the microfluidics core facility to observe the effects of the one-two

punch strategy on the tissues, thus confirming the effectiveness of the method.

A defining discovery

Another highlight of the last year for Ferbeyre's laboratory is undoubtedly the publication of an article signed by Stéphane Lopes-Paciencia and other researchers from his team in the prestigious journal *Cell Reports*, in which they establish the crucial role of chromatin in the response of cells to oncogenic stress.

When they detect the presence of stress that promotes the appearance of tumours, cells can set up responses, such as cell death or cell senescence, thereby preventing the proliferation of potential tumour cells. Researchers have observed that oncogenic stress opens chromatin—a substance that packs and organizes DNA in cells—and that this opening can be artificially induced to accelerate senescence.

Gerardo Ferbeyre also notes an astonishing fact: "Research over the past 50 years has focused on the coding part of the genome, which accounts for only 5% of the entire genome. The rest remains a mystery and we found that the chromatin opening process, which occurs during senescence, targets this non-coding region." By exposing the non-coding chromatin to different drugs, senescence can be induced. The study also reveals that chromatin retains a memory of oncogenic stress—an interesting pathway to exploit when developing cancer therapies.

Through his research and his various roles, Ferbeyre wishes to leave his mark in several ways: “On a human level, I hope to contribute to reducing human suffering. As a researcher, I would like to discover answers to the big questions that have not yet been solved by science. As a teacher, I am proud to train the new generations who will take over. And as Director of the Cancer Research Theme, I would like to follow in the footsteps of excellence of the person before me. ”

Research Theme Highlights

Cancer Research Theme

May 2023

Researchers Dominic Roy and Bertrand Routy share $500,000 in career grants awarded as part of the Fonds de recherche du Québec en santé (FRQS) scholarship program.

June 2023

In collaboration with the MUHC and St. Mary’s Hospital Centre, Dr. Moishe Liberman’s team conducts a clinical trial to improve the treatment of non-small cell lung cancer.

A study by John Stagg’s team is published in eLife highlights the essential role of the CD73 enzyme in supporting the energy and metabolic needs of cancer cells.

July 2023

A clinical trial conducted by Dr. Bertrand Routy, in collaboration with the Marathon of Hope Cancer Centres Network, shows that fecal transplants hold promise for improving melanoma treatment.

January 2024

As part of the CRCHUM Awards of Excellence, Dr. Moishe Liberman receives the Career Award, highlighting his contribution to research through his nearly 60 clinical trials and to nearly 170 publications.

For his part, Dr. Bertrand Routy is awarded the Scientific Contribution of the Year Award for his work published on fecal transplants in *Nature Medicine*.

The Montreal Cancer Institute (the Institute) supports researchers in the CRCHUM's Cancer Research Theme by giving them the means to defeat cancer.

INSTITUT DU CANCER DE MONTRÉAL

The Institute finances basic or clinical research projects, the purchase of state-of-the-art equipment, awards scholarships to the student community and participates in organizing scientific conferences. During the year 2023-2024, the Institute allocates more than $2.5 million to the CRCHUM Cancer Research Theme, including $500,000 to the Guy Lafleur Fund of the CHUM Foundation supporting projects in precision oncology.

The Institute has also awards seed grants for projects on triple-negative breast cancer, cellular senescence in melanoma, and intraductal carcinoma of the prostate, to name a few.

A springboard for youth mental health

Dr. Amal Abdel Baki

NEUROSCIENCE RESEARCH THEME

In July 2023, Dr. Amal Abdel-Baki received the Angelo Cocchi Award at the 14th International Conference on Early Intervention in Mental Health (IEPA), held in Lausanne, Switzerland. This recognition highlights her contributions to the implementation of early intervention for the first episodes of psychosis, which is one of her main research interests.

From the beginning of her career as a psychiatric researcher, almost 20 years ago, she was interested in young people living with a severe mental disorder, such as schizophrenia or bipolar disorder, as well as the impact of these diseases on their functioning. “These people are coming into a pivotal period where they have to make important life decisions, which the disease can influence, so it’s important to offer them the best treatments at the right time,” she explains.

The influence of social factors

Over the past year, Dr. Abdel-Baki and her team have been preparing a publication on the impact of cannabis use among young people on the progression of their disease and their ability to function.

“This is just one example, but we’re looking at several social determinants of health. How does the context in which young people live—for example, being an immigrant, a racialized person or a woman, or having had traumatic experiences during childhood—influence the course of the disease and their chances of recovery?”

A model adapted to Quebec

With this in mind, Dr. Abdel-Baki continued the work she started in 2019 on the implementation of SARPEP (Rapid Learning System for First Episode Psychosis Programs), intended for stakeholders of programs specializing in early intervention for first psychotic episodes (FEPP). Its goal: To improve the quality of care under Quebec’s FEPPs, which is a priority for the Ministère de la Santé et des Services sociaux. How: by detecting the disease and intervening effectively as early as possible to avoid the deterioration of the mental health and the social, family and professional functioning of young patients.

"The effectiveness of this model has been demonstrated in several studies and meta-analyses around the world, so the challenge is to integrate it on a large scale into the Quebec model. SARPEP is actually a community of practice, bringing together researchers, clinicians, managers, policy makers, patients and their families who together determine how to improve practices."

— Dr. Amal Abdel Baki

A provincial influence—and beyond!

With SARPEP now deployed in 20 sites representing various realities in practice settings, Dr. Abdel-Baki and her collaborators collect data, provide feedback to teams and offer reinforcement activities to teams to maximize the effectiveness of health professionals' interventions. For example, patients' perspective is measured using a questionnaire addressing nine dimensions of the evolution of their recovery, such as satisfaction with their physical and mental health, their autonomy in accommodation and their ability to carry out studies or work.

“My research and clinical practice with my team of health professionals have always fed off each other, and I think that this allows us to have a real impact on patients,” says Dr. Abdel-Baki.

The goal now is to extend SARPEP to all FEPPs in Quebec within two years. At the same time, Dr. Abdel-Baki and her fellow researchers organized a pan-Canadian event at the CRCHUM to explore how the learning system could be adapted to other provinces.

Research Theme Highlights

Neuroscience Research Theme

May 2023

Élie Bou Assi and Dr. Jean-Philippe Miron receive a career grant awarded as part of the Fonds de recherche du Québec en santé (FRQS) scholarship program. Bou Assi also receives a $197,500 Discovery Grant from NSERC.

June 2023

With funding from Fighting Blindness Canada, Adriana Di Polo will collaborate with the Center for Eye Research Australia to discover the link between blood supply and optic nerve damage in glaucoma.

July 2023

Nicole Leclerc and Alex Parker are awarded CIHR Project grants totalling $1.6M to continue their research.

August 2023

The Canada Research Chair in Multiple Sclerosis, led by Dr. Alexandre Prat, is renewed.

Université de Montréal's Department of Psychiatry and Addictology created the SARPEP Fund, held by Dr. Amal Abdel-Baki, with a philanthropic grant of $900,000.

September 2023

Dr. Didier Jutras-Aswad receives nearly $700,000 from the Fonds de recherche du Québec to study the non-therapeutic use of cannabis in young adults.

January 2024

Dr. Catherine Larochelle wins the Emerging Researcher Award as part of the 2023 CRCHUM Awards of Excellence.

February 2024

Dr. Alexandre Yves Poppe is awarded a Project Grant of $439,874 for his research on endovascular intervention in acute stroke.

March 2024

Christine Vande Velde receives $300,000 from the ALS Society of Canada and the Brain Canada Foundation.

Nathalie Arbour wins a grant of $300,000 from the Multiple Sclerosis Society of Canada.

Rethinking transfusion care

Dr. François Martin Carrier

HEALTH INNOVATION AND EVALUATION HUB RESEARCH THEME

What strategies could reduce the use of blood transfusions in certain surgical contexts, particularly in liver transplants? This is one of the questions that Dr. François Martin Carrier is attempting to answer as the holder of the Héma-Québec–Bayer Chair in Transfusion Medicine, Université de Montreal.

Dr. Carrier has had an atypical career path. First, he was a clinician: an anesthesiologist and intensivist specializing in liver diseases at the CHUM for seven years before starting his research career in 2018. His path has been an asset, allowing him to identify certain gaps in his practice and motivating him to continue his studies to become a researcher.

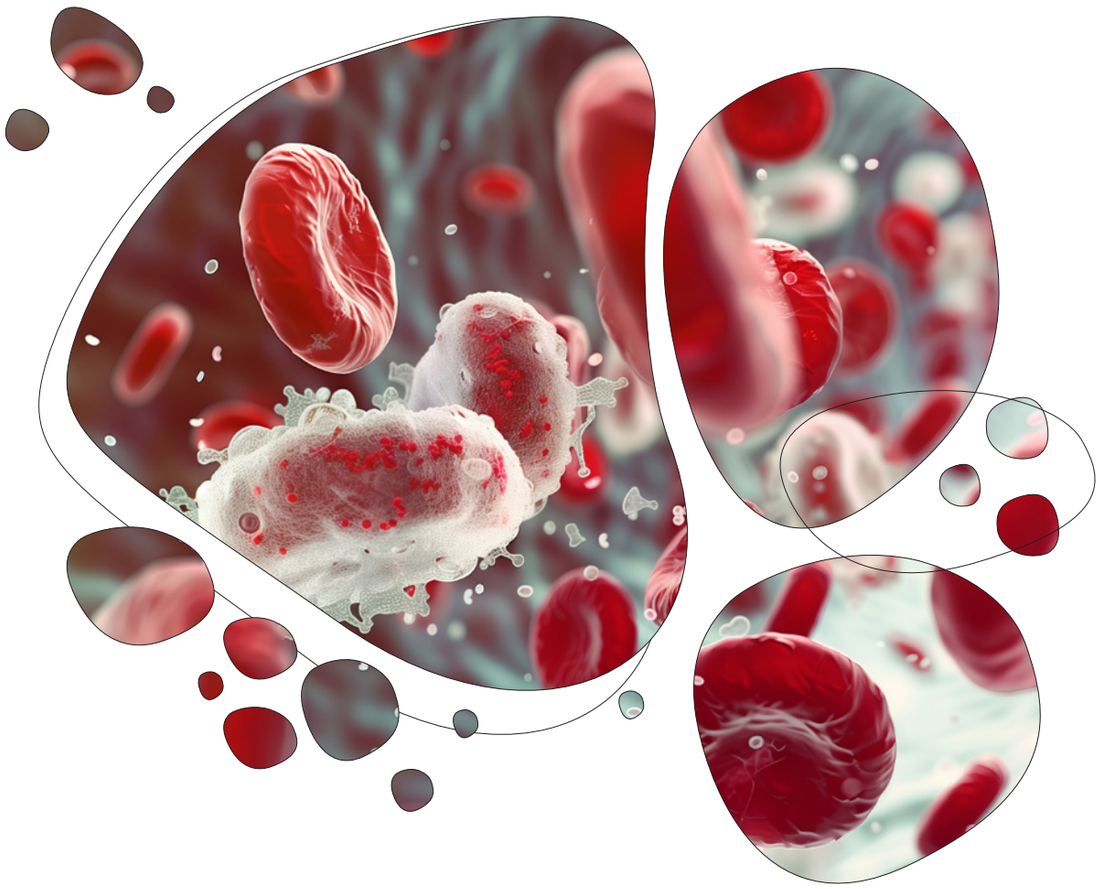
“Liver transplants have always fascinated me,” he remarks, enthusiastically. “It is an important operation, performed on patients who are very ill and who require intensive care. During my residency, it was normal to hear that the days were numbered for a cirrhotic patient when they were admitted to intensive care. I found that there wasn’t a lot of clinical expertise in this field, so I decided to delve deeper into these issues with the goal of improving patients’ trajectories.”

An overused practice?

As Dr. Carrier points out, blood transfusion saves countless lives, but it can involve complications for certain people. The presence of water in the lungs, increased risk of infection and destabilization of the immune system are among the side effects that can increase risks of complication. However, it is not clear whether these effects occur because the individual receiving the transfusion is already ill or if they are partially caused by the transfusions themselves. In rare cases, incompatibility leading to the destruction of red blood cells has been observed.

In addition to these potential complications, there are challenges associated with prolonged hospital stays, high costs of transfusions and the risk of blood shortages, which sometimes leads to cancelling surgeries that require transfusions. “If we can better understand the mechanisms at play, we will have a means of rais-

ing awareness among clinicians to reduce unnecessary transfusions for patients. “I think this will help make our health care system more resilient,” says Dr. Carrier.



Promising studies

To try to elucidate these questions, among others, Dr. Carrier and his team undertook a multicentre cohort study involving 850 patients who underwent liver transplants at eight transplant centres, six in Canada and two in France. Data was collected throughout the year and its ongoing analysis will, among other things, establish links between transfusions and patients’ clinical conditions, ultimately aiming to reduce the use of blood and to implement optimal care processes.

In parallel with this incredible achievement, a few months ago Carrier also launched a multicentre randomized clinical trial on liver transplants, comparing the results of two intraoperative hemodynamic management strategies performed on Canadian patients to

determine if one of them helps reduce bleeding, transfusions and postoperative complications. This study is being conducted in collaboration with three hospitals to start with—the CHUM, the London Health Sciences Center and the MUHC—but others will be included throughout the trial, possibly in France.

Other projects on transfusion risks affecting different patient profiles in surgery are in the launch phase, notably thanks to the support of the CITADEL platform (CHUM's Centre for the Integration and Analysis of Medical Data).

"The projects that I have implemented all aim to address questions I have asked myself at a patient's bedside. As a methodology enthusiast, I love racking my brain to find the right answer to the question!"

— Dr. François Martin Carrier

Research Theme Highlights

Health Innovation and Evaluation Hub Research Theme

April 2023

Ms. Ghislaine Rouly, a patient partner, is co-leading a Canada Research Chair with Dr. Antoine Boivin, making her the first person to be appointed to this position based on her experience rather than her credentials.

May 2023

The FRQS scholarship program awards scholarships to five researchers in the research theme: Gabrielle Pagé, Dr. Laura Drudi, Dr. Isabelle Éthier, Dr. Han Ting Wang and Dr. Mark Keezer.

June 2023

Isabelle Doré receives a grant for her project, Co-ACTIF, a multimodal tele-rehabilitation program aimed at improving the physical and mental health of cancer patients.

July 2023

Three of our teams, led by Dr. Michaël Chassé, Anita Koushik and Marie-Pascale Pomey, receive funding from CIHR.

August 2023

The Canada Research Chair in Innovation and Technologies for Youth Mental Health Services, led by Shalini Lal, is renewed.

September 2023

José Côté, a pioneer in telehealth nursing practices, is awarded the CASN Nursing Research Excellence Award.

Dr. Marie-France Raynault, researcher and director of the Léa-Roback Center for Research on Social Inequalities in Health in Montreal, has been appointed president of the Canadian Academy of Health Sciences (CAHS).

October 2023

Manon Choinière's team receives nearly $900,000 in funding from the Ministry of Health to improve quality of life for people living with chronic pain.

February 2024

Dr. Antoine Boivin and Ghislaine Rouly receive $100,000 from CIHR for their participatory multiple case study with homeless individuals; Nadia Sourial receives the same amount for her research on performance indicators optimizing primary care practices.

Transforming patients' lives

Line Beaudet

CAREER HIGHLIGHTS

When Line Beaudet talks about the patients and care-givers who she supports through the programs set up by her and her team, it's always with plenty of emotion. As a neuroscientist, a passion that she passes on as an associate professor at Université de Montréal, and an outstanding researcher, Beaudet has acquired a great deal of empathy during her nursing practice, which allows her to pilot projects that are deeply rooted in the lived experiences of her patients.

Her exceptional contributions were celebrated last April with the presentation of the 2024 Prix reconnaissance by members of the Parkinson's disease and parkinsonian syndromes research group at Université de Montréal's Faculty of Medicine. In 2019, she also received an award in the category *Excellence in care* from the Ordre des infirmières et infirmiers du Québec, highlighting the quality of her contributions, which combine clinical work, research and teaching.

Living better with Parkinson's

Over the past year, in conjunction with Parkinson Québec, Line Beaudet has continued to roll out a bilingual program called EMPATIC, which includes three types of web-based interventions aimed at making life easier for people living with this disease and their caregivers.

Also produced in collaboration with José Côté and members of the Research Chair on new nursing practices, EMPATIC includes inspiring testimonials shared by people living with Parkinson's and their caregivers, who address different themes from different points in their journeys with the disease; expert advice from health professionals to address the challenges related to the disease; and TAVIE™ in motion, a platform currently composed of 11 interactive sessions led by a virtual nurse, whose goal is to communicate personalized information and resources to patients in order to increase their quality of life with Parkinson's.

A testament to EMPATIC's relevance: as of December 31, 2023, the videos had exceeded 100,000 views, with more than 20,000 recurring users! "This allows people from all regions of Quebec and across 92 countries to have access to high-quality care while avoiding significant costs," Beaudet says.

An engine for recovery from an ischemic stroke

Beaudet has also co-created another project, the parcours Locomotive, with Dr. Céline Odier, Marie-Andrée Desjardins, patient partners and the CHUM Centre de littératie en santé. It explains exercises, information and strategies through posters accessible in person and online to promote recovery after a stroke, whether in the hospital, at home or in a rehabilitation centre.

The posters have been specifically designed to account for patients' physical, visual and cognitive changes. The course has been improved over the years with audio guides, web exercise capsules and stimulation notebooks. So far, six other health facilities in Quebec have adopted the parcours Locomotive.

For a smooth transition

Additionally, in collaboration with colleagues Dominic Chartrand and Dr. Anne Lortie from CHU Sainte-Justine, Vanessa Léger and Dr. Mark Keezer from CHUM, Sylvie Le May from Université de Montréal's Faculty of Nursing, young people living with epilepsy and caregiver partners, Beaudet helped implement a project to help these young people with the transition from a pediatric facility to an adult facility.

Building on this team experience, Dr. Mark Keezer and Dr. Philippe Major (CHU de Sainte-Justine) designed Université de Montréal's Transition en épilepsie complexe (TÉCUM) program, which aims to establish a new model of care for young people struggling with this condition and other comorbidities.

Giving back hope

Beaudet's multidisciplinary expertise in the fields of neuroscience, caregiving, methodology, pedagogy and nursing makes her an invaluable research resource.

In addition, her manner of including caregivers in her programs is proving successful, making it possible to influence various health policies: "Patients are with us only a small part of their lives. Caregivers are therefore essential to understanding their needs. What I am passionate about is listening to dyads, developing programs with them to better support them, making a real difference in the lives of people who, at the start, did not have much hope after their diagnosis."

— Line Beaudet

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CRCHUM

RESEARCH CENTRE