



# McMaster University Research Centres & Institutes

2021 Annual Aggregated Report

## An overview of 2021

The success of McMaster's Research Centres and Institutes (RCIs) is dependent upon the people – the directors, faculty, staff and students – who work within them. I'm happy to share some of those successes with you, in this RCI annual report. Through the 2021 reporting process, I was repeatedly reminded of the high-quality work coming out of our multidisciplinary and Faculty-based RCIs. I'd be remiss if I didn't recognize the individual and collective contributions of all those involved; particularly their dedication during the specific challenges associated with the global pandemic. Often, their support was critical in McMaster's efforts in the fight against COVID-19 and they continued to provide leadership in our visioning of a post-pandemic world.

Our excellence in research is driven by the efforts of our research community – efforts that are amplified through our RCIs. These centres and institutes allow our faculty members and their research teams to focus on the most pressing and demanding problems facing society, to pool their talents and resources, and to maximize institutional impact and output. Specifically, RCIs allow us to advance our strategic research objectives; to enhance research collaborations; to facilitate interdisciplinary research; to stimulate partnerships; to expand our research presence on the global stage; to increase our ability to secure funding for major research initiatives; and to strengthen the linkages between research and teaching.

In 2021 McMaster established three new RCIs: i) Centre for Excellence in Protective Equipment and Materials (CEPEM) with Dr. Ravi Selvaganapathy as Director ii) Centre for Discovery in Cancer Research (CDCR) with Dr. Shelia Singh as Director and iii) Schroeder Allergy and Immunology Research Institute, with Dr. Susan Waserman as Director. In addition, Dr. Tracy Bear joined the university as Director of the McMaster Indigenous Research Institute (MIRI). Dr. Bear holds joint appointments in the Faculties of Social Sciences and Health Sciences.

In June, the policy document [Guidelines for the Governance and Review of Research Institutes, Centres and Groups](#) was approved by the Board of Governors. These updated guidelines recognize the importance of RCIs in the university's research enterprise. In accordance with the new policy, 11 external RCI reviews were initiated, and the overwhelming message was an acknowledgement of the excellence of the centres and institutes reviewed, and the work of the directors. The review process and the expertise of the review board members allowed us to gain critical feedback for the future strategic direction of RCI activity.

With funds from the Office of the Vice-President, Research, we established a new initiative – the RCI Undergraduate Summer Research Program. In this first year, 12 undergraduates – spread evenly across the Faculties – received support to work in a centre or institute of their choice, often gaining their first experience in a research environment.

This aggregated report speaks to both the qualitative and quantitative impact of our 63 centres and institutes during 2021, and it's an amazing story. More than 50% of McMaster's peer reviewed journal publications were enabled by one or more of our RCIs. They directly benefitted close to 500 post-doctoral fellows, nearly 2300 graduate students, and some 2100 undergraduate students. And, they advanced the work of almost 1400 external collaborators, for example those working with our industrial partners, not-for-profits, and government organizations.

Dr. Andy Knights  
Associate Vice-President, Research  
Office of the Vice-President (Research)



# RCIs By the Numbers

Interacting with RCIs in 2021:



Faculty<sup>1</sup>



Postdoctoral  
Fellows<sup>2</sup>



Graduate  
Students<sup>3</sup>



Undergraduate  
Students<sup>4</sup>



Other Academic  
Researchers<sup>5</sup>



Other  
Non-Academic  
Researchers<sup>6</sup>

1 Total number of faculty member/RCI interactions  
2 Number of PDFs supported by our RCIs  
3 Number of graduate students supported by our RCIs  
4 Number of undergraduates working with RCIs  
5 Number of non-McMaster academic researchers interacting with our RCIs  
6 Number of external collaborators such as from industry, not-for-profits, and government, supported by our RCIs

# RCIs By the Numbers

Enabled by RCIs in 2021:



Journal Publications



Conference Proceedings



Conference Presentations



Graduate Degree Completions



Undergraduate Senior Projects



Reports for External Organizations



Intellectual Property Disclosures

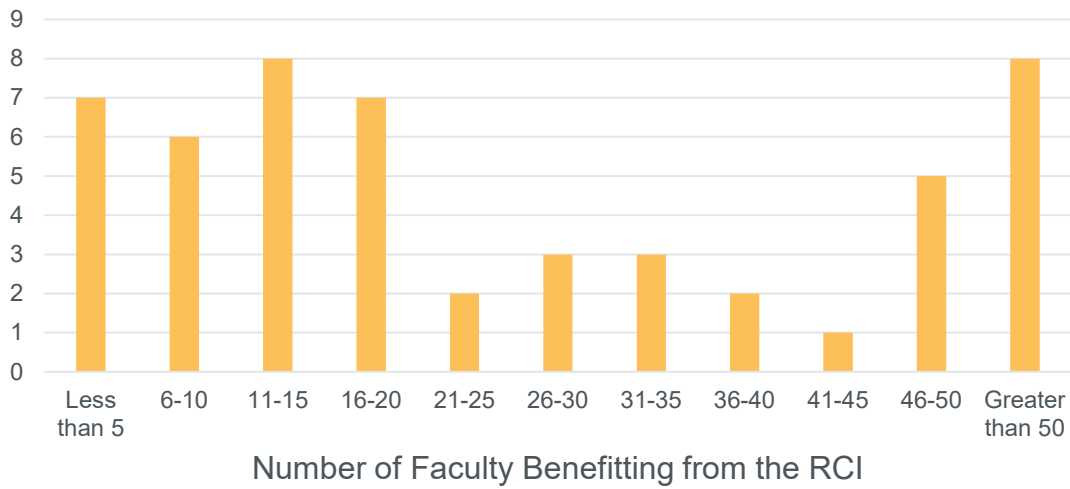


Patents

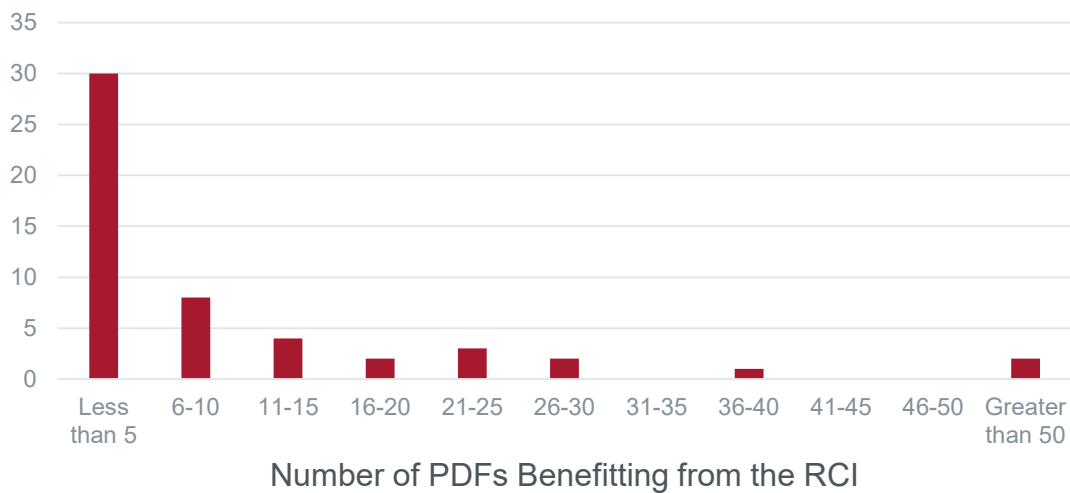


Licences to External Organizations

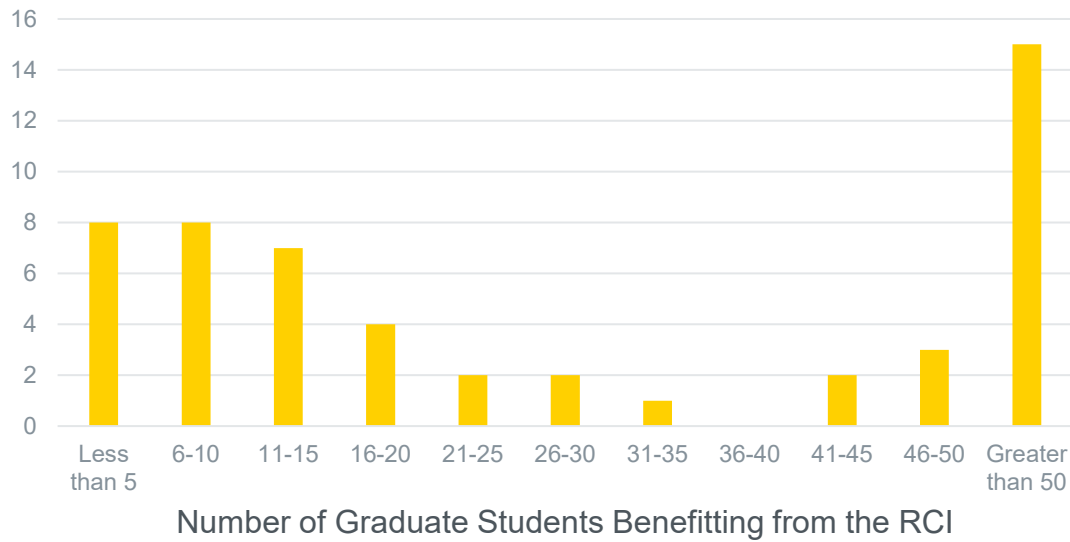
### Number of RCIs versus McMaster faculty member Beneficiaries



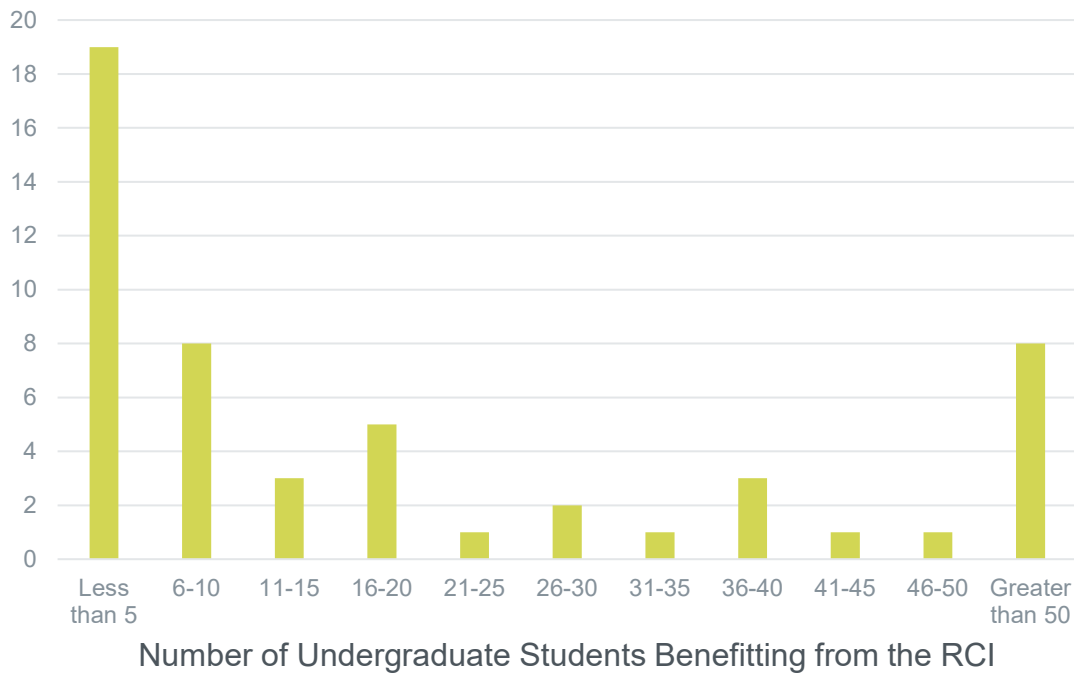
### Number of RCIs versus Postdoctoral Fellow Beneficiaries



### Number of RCIs versus Graduate Student Beneficiaries



### Number of RCIs versus Undergraduate Student Beneficiaries



# Research Impact and Influence examples

## Visualizing coronavirus-cellular infections

Researchers at the [Canadian Centre for Electron Microscopy \(CCEM\)](#) – which houses a suite of some of the world’s most advanced imaging tools, capable of measuring materials and chemistry at ultra-high resolution – are using advanced technologies to track the real-time evolution of the HCoV 229E coronavirus for early surveillance of the virus’ transmissibility and infectiousness.

While cryo-electron microscopy has helped researchers determine the shape of the spike protein and better provide models for how infection might occur, it’s proven difficult to capture an infection event in an actual cell. CCEM researchers have overcome this challenge by using a technique called focused ion beam nanotomography, which allows scientists to slice a block of material – similar to slicing cheese at a deli – for a full 3-D image.

Working with researchers in the Faculty of Health Sciences and the Ontario company Fibics, CCEM scientists imaged the infection of lung cells by the SARS-CoV2 analogue in order to provide context for the spike-cell interaction. Ultimately, they were able to capture the exact moment of viral infection in 3-D, providing direct insight into the biomechanics of the interaction and allowing researchers to determine the effects of different treatments on viral infection.

The study has opened a world of possibilities for biomedical imaging applications in other fields.



## Sparking social research innovation

Obtaining ethical approval, collecting and analyzing data in real-time, and sharing actionable findings are difficult without face-to-face meetings with subjects. Which is why the pandemic dealt social research such a blow.

Enter [Spark - a centre for social research innovation](#).

Up and running for just a year-and-a-half, the centre for social research sprang into action to deliver a weekly virtual speaker series featuring leading experts from around the world. For 40 weeks, social research methods and tools were shared with more than 250 virtual attendees. Proving so popular, the sessions continue today as Spark Talks, and a toolkit has been developed to guide researchers in socially distanced yet deeply engaged qualitative research.

Add one-on-one training on a specific design or methodology challenge, fee-for-service research support, and a dedicated space for collaborative, interdisciplinary research, and it’s easy to see why academics, businesses, governments and community organizations alike are making Spark their go-to source for the tools needed to solve complex social problems.



### Next-generation biosensing technologies

A team of McMaster researchers working at the forefront of biosensing technology has developed a next-generation, rapid saliva test for COVID-19 that could soon be available for home use.

The antigen test is easier, faster and more accurate than any current point-of-care diagnostic. It requires only a small saliva sample and delivers results in 10 minutes, using an electrochemical sensor system similar to a glucose sensor. Validated using over 70 clinical samples, the test has shown foolproof accuracy in identifying users who are Covid free.

The new technology represents the combined efforts of more than a dozen scientists across three faculties, led by Drs. John Brennan (chemistry and chemical biology), Yingfu Li (biochemistry and biomedical sciences), and Leyla Soleymani (engineering physics). Their work was funded by more than \$2 million from the Canadian Institutes of Health Research and other sources.

A major part of this work was carried out at the McMaster's **Biointerfaces Institute (BI)** of which Brennan is Director. This state-of-the-art facility is uniquely equipped to help scientists develop portable, easy-to-use tests. The antigen test is one of many developed by McMaster researchers to enable rapid and accurate detection of such deadly infections as S. Aureus, C. difficile and Legionnaires' disease.

Zentek, a Canadian biotechnology company, has licensed and is working to commercialize the new COVID-19 test and is partnering with McMaster to develop diagnostic tests for other pathogens.

### Seeing through the smoke

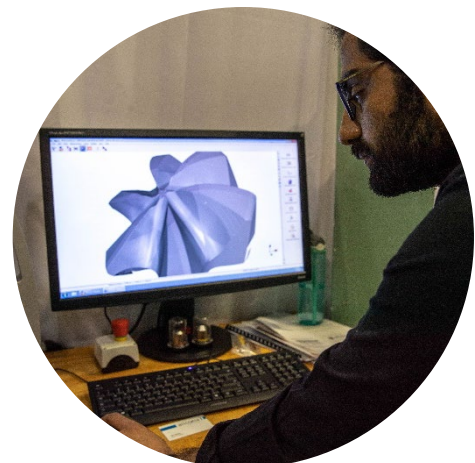
Protecting firefighters on the job can mean the difference between life and death – for them and those they're trying to save – and one of the biggest challenges is seeing through heavy smoke. Thanks to the **McMaster Manufacturing Research Institute (MMRI)**, Canada's most advanced and best equipped manufacturing research laboratory, a solution is just around the corner.

Teams of MMRI researchers are applying advanced surface engineering concepts to help Longan Vision, a start-up company founded by McMaster alumni and students, produce an innovative augmented reality visor with thermal imaging. It features an easy-to-read heads-up display that lets firefighters see through smoke, examine the structure of a building, locate team members and victims, and check for fire sources.

For the "smart visor system" MMRI researchers designed and developed a novel coating that meets operating temperature requirements, is scratch resistant, and has the desired reflective properties to support the optical projection of images.

Following a series of prototypes, MMRI is providing further support to Longan Vision as it works to ramp-up manufacturing. But their work is already being recognized – Longan Vision was recently honored as one of the 101 top "Canada based Product Design companies" by Best Startup Canada.

The partnership with Longan Vision is just one example of how MMRI is fueling manufacturing innovation and the commercialization of new products through aggressive technology transfer across a wide range of industries, from automotive and aerospace, mould and die companies, food preparation, medical devices and nuclear refurbishment and small modular reactors (SMRs).





## Stepping up for older adults

Social Isolation and mobility limitations are challenges that many older adults face. As COVID-19 began impeding contact between friends and families — important supports to older adults physical and mental health — the **McMaster Institute for Research on Aging (MIRA)** sprang into action with initiatives to help older adults stay active and engaged.

- Housed at MIRA, the Canadian Longitudinal Study on Aging (CLSA) received over \$6 million from funders and partners to study the long-term impact of COVID-19 on health and wellbeing, including aging brains. This is in addition to \$76 million of federal funding CLSA received to support its next phase of research.
- Over 15 related publications following this funding — for example, research led by Dr. Parminder Raina in *Nature Aging* found that 43% of adults 50+ experienced moderate or high levels of depressive symptoms at the beginning of the pandemic that increased over time. This research has been shared in over 35 news outlets internationally.
- \$75,000 in Covid-19 grants to study the impact of social distancing on older Hamiltonians, along with innovative ways to improve it.
- Covid-19 content on MIRA's Optimal Aging Portal to help older adults and those who care for them make informed decisions.
- A study to gauge the mental health impact of the pandemic on working adults in Hamilton and suggest appropriate coping strategies.
- Bringing older community members and McMaster undergraduates together online to reduce social isolation and help students learn about diverse experiences of aging.

MIRA also worked to address the needs of its member researchers and trainees, conducting a survey on supports for those affected by the pandemic, hosting Idea Exchange webinars to explore challenges faced by cross-Faculty research teams, and offering extensions to all active funded research.

These outreach efforts ensured there was no interruption in MIRA's internationally renowned work advancing the science of aging and creating useable, practical, older adult-centred solutions that promote aging in place.



## Beating the drums for democracy

At a time when democracies everywhere are under siege, McMaster's **Centre for Human Rights and Restorative Justice (CHRRJ)** is showing just how much can be done to counteract the spread of authoritarianism.

Its global network Participedia has become the largest database of its kind in the world, an open-access crowdsourcing platform, similar to Wikipedia, for researchers, activists, practitioners and others interested in public participation and democratic innovations. Users can conduct research, contribute content, create teaching material, and more.

In its first five years of operation, Participedia documented more than 1,600 cases and 330 methods of democratic innovation around the world. Last year, it expanded its scope to include five new research areas, organized a new Teaching, Training and Mentoring Committee, and introduced a student-run podcast and co-design workshops.

CHRRJ's impact around the world is being felt in other ways. Director Bonny Ibhawoh, who holds the Senator William McMaster Chair in Global Human Rights, amassed a team of graduate students to help the Global Climate Assembly with its first ever presentation to COP26, the United Nations Climate Change Conference. And CHRRJ is assisting Research Assistants with a series of essays to be released with *Public Agenda*, a U.S. organization dedicated to strengthening democracy.

Which goes to show that human rights and restorative justice can take many forms

## Sifting the wheat from the chaff on social media

Why do some people believe in fake news on social media while others do not? Researchers in the [McMaster Digital Transformation Research Centre \(MDTRC\)](#) think it may have less to do with ideology and more to do with social media itself and the mechanisms through which users interact with information on these platforms.

With support from a Social Sciences and Humanities Research Council (SSHRC) Insight grant, they are testing their hypothesis, which will enable them to develop information technology (IT) interventions that make it easier for social media users to spot the real from the fake.

Leading the team is DeGroote School of Business Dean Khaled Hassanein, former director of MDTRC, and associate professor Goran Calic, who blends psychology and mathematical modeling with computer science and strategic management. They're collaborating with Mahdi Mirhoseini at Concordia University, a former postdoctoral fellow at MDTRC.

They believe that understanding how individuals process and respond to online information is key. Most research to date has focused on psychological and political drivers, but Hassanein and Calic will examine the role of social media itself.

Specifically, they plan to study the impact of different types of social media on two cognitive mechanisms which cause users to believe in fake news: classical reasoning, whereby users choose impulsivity over deliberation (typical of fun-seeking Facebook users); and motivated reasoning, whereby users believe information that supports what they already think (those who favor Medium, as an example). As capturing cognitive processes is not possible using traditional methods, researchers will use Electroencephalography (EEG) as a measurement tool. They will then design specific IT interventions targeted to each type of user.

Their project is the latest example of MDTRC's cutting-edge multidisciplinary research aimed at better understanding how the digital age revolution is impacting individuals and transforming organizations and society at large.



## Bringing Black history to light

A former slave turned town crier, the first Black Methodist congregation, an early troupe of travelling Black musicians, a 1947 all-Black women's basketball team.

If you're wondering which U.S. city lays claim to these, you're on the wrong track. They're all part of the rich history of the Black community in Hamilton, Ontario, and they've only recently come to light thanks to a project funded by McMaster's [Centre for Community Engaged Narrative Arts \(CCENA\)](#).

Recognizing the inherent value of diverse communities' stories as an important way to address the inequities in our world, CCENA worked in concert with the Afro-Canadian Caribbean Association of Hamilton (ACCA) and the Hamilton Black History Council, to create a Hamilton Black History Database.

Together, they hired Aaron Parry, a McMaster arts student from Hamilton's Black community, to survey Black History resources in archives and personal collections around the city. His task had one goal--to bring local Black history to light and make it accessible to current and future generations.

The database, launched in February 2022, includes a searchable catalogue of personal testimonies, music, photos, videos, newspaper articles and website links. It has become an invaluable "one-stop shop" for Hamilton's Black history resources and archives, many of which exist in scattered places around the city or in archives inaccessible to the public.

Parry hopes the database will instill pride among members of Hamilton's Black community and serve as a rich educational tool for young people. The site will be updated regularly, ensuring it remains an important and constant resource for all Hamiltonians and an important tool in sustaining art-based community listening, remembering, and story-making.

# List of Research Centres and Institutes

Bertrand Russell Research Centre  
Director: Dr. Alex Klein

Biointerfaces Institute  
Director: Dr. John Brennan

Brockhouse Institute for Materials Research  
Director: Dr. Alex Adronov

Canadian Centre for Electron Microscopy  
Director: Dr. Nabil Bassim

Can-Child: Centre for Childhood Disability Research  
Director: Dr. Dina Brooks

Centre for Advanced Research in Experimental and Applied Linguistics  
Director: Dr. Ivona Kucerova

Centre for Ancient Numismatics  
Co-Directors: Dr. Spencer Pope and Dr. Martin Beckmann

Centre for Clinical Neuroscience  
Director: Dr. Flavio Kapczinski

Centre for Community-Engaged Narrative Arts  
Co-Directors: Dr. Lorraine York and Dr. Daniel Coleman

Centre for Emerging Device Technologies  
Director: Dr. Ayse Turak

Centre for Excellence in Protective Equipment and Materials  
Director: Dr. Ravi Selvanganapthy

Centre for Health Economics & Policy Analysis  
Director: Dr. Jean-Eric Tarride

Centre for Human Rights and Restorative Justice  
Director: Dr. Bonny Ibhawoh

Centre for Mechatronics and Hybrid Technologies  
Director: Dr. Saied Habibi

Centre for Metabolism, Obesity, and Diabetes Research  
Co-Directors: Dr. Katherine Morrison and Dr. Gregory Steinberg

Centre for Networked Media and Performance  
Acting Director: Dr. Christine Quail

Centre for Peace Studies  
Director: Dr. Chandrima Chakraborty

Centre for Research in Micro- and Nano-Systems  
Director: Dr. Jamal Deen

Chanchlani Research Centre  
Director: Dr. Sonia Anand

David Braley Centre for Antibiotic Discovery  
Director: Dr. Gerry Wright

Escarpment Cancer Research Institute  
Director: Dr. Mark Levine

Farncombe Family Digestive Health Research Institute  
Director: Dr. Steve Collins

Biomedical Engineering and Advanced Manufacturing  
Director: Dr. John Brennan

General Motors Centre for Automotive Materials and Corrosion  
Director: Dr. Joey Kish

Gilbrea Centre for Studies in Aging  
Acting Director: Dr. Meredith Girffin

Institute for Multi-Hazard Systemic Risk Studies  
Director: Dr. Wael El-Dakhakhni

Institute on Ethics and Policy for Innovation  
Director: Dr. Claudia Emerson

Institute on Globalization and the Human Condition  
Director: Dr. Petra Rethmann

L.R. Wilson Institute for Canadian History  
Director: Dr. Ian McKay

Labarge Centre for Mobility in Aging  
Director: Dr. Parminder Raina

Lewis and Ruth Sherman Centre for Digital Scholarship  
Director: Dr. Andrea Zeffiro

MacData Institute  
Director: Dr. Paul McNicholas

McMaster Cancer Research Centre  
Director: Dr. Shelia Singh

McMaster Centre for Climate Change  
Director: Dr. Altaf Arain

McMaster Centre for Scholarship in Public Interest  
Director: Dr. Henry Giroux

McMaster Centre for Software Certification  
Director: Dr. Richard Paige

McMaster Centre for Transfusion Research  
Director: Dr. Donnie Arnold

McMaster Digital Transformation Centre  
Director: Dr. Milena Head

McMaster Immunology Research Centre  
Director: Dr. Carl Richards

McMaster Indigenous Research Institute  
Director: Dr. Tracey Bear

McMaster Institute for Energy Studies  
Director: Dr. Dave Novog

McMaster Institute for Music and the Mind  
Director: Dr. Laurel Trainor

McMaster Institute for Research on Aging  
Director: Dr. Parminder Raina

McMaster Institute for Transport and Logistics  
Director: Dr. Saideh Ravazi

McMaster Institute of Health Equity  
Acting Director: Dr. Marisa Young

McMaster Manufacturing Research Institute  
Director: Dr. Stephen Veldhuis

McMaster Midwifery Research Centre  
Director: Dr. Beth Murray-Davis

McMaster Physical Activity Centre of Excellence  
Director: Dr. Stuart Phillips

McMaster Steel Research Centre  
Director: Dr. Joe McDermid

McMaster University Centre for Buddhist Studies  
Director: Dr. James Benn

McMaster Centre for Effective Design of Structures  
Co-Directors: Dr. Wael El-Dakhakhni and Dr. Mike Tait

Michael G. DeGroot Centre for Medicinal Cannabis  
Research  
Director: Dr. James MacKillop

Michael G. DeGroot Cochrane Canada Centre at  
McMaster  
Director: Dr. Holger Schunemann

Michael G. DeGroot Institute for Infectious Disease  
Research  
Director: Dr. Lori Burrows

Michael G. DeGroot Institute for Pain Research and  
Care  
Director: Dr. Norm Buckley

Michael G. DeGroot National Pain Centre  
Director: Dr. Norm Buckley

Offord Centre for Child Studies  
Director: Dr. Ellen Lipman

Population Health Research Institute  
Director: Dr. Salim Yusuf

Schroeder Allergy and Immunology Research Institute  
Director: Dr. Susan Wasserman

Spark: A Centre for Social Research Innovation  
Director: Dr. Michelle Dion

Statistics Canada Research Data Centre at McMaster  
Director: Dr. Michael Veall

The McMaster Origins Institute  
Director: Dr. Jonathon Stone

Thrombosis and Atherosclerosis Research Institute  
Director: Dr. Jeffery Weitz