Breakout Session 2: Track A

Ethical Development of Colorectal Cancer Imaging Biomarkers

Dr. Amber Simpson
Associate Professor/Canada Research Chair, Queen's University

Ms. Rohan Faiyaz Khan
PhD Student, Queen's University

Ethical Development of Colorectal Imaging Biomarkers

Dr. Amber Simpson (she/her), Canada Research Chair in Biomedical Computing and Informatics

Associate Professor, Department of Biomedical and Molecular Sciences / School of Computing

Director, Centre for Health Innovation

Senior Investigator, Canadian Cancer Trials Group

Affiliate Member, Vector Institute for AI

Rohan Faiyaz Khan (she/they), PhD Student, School of Computing

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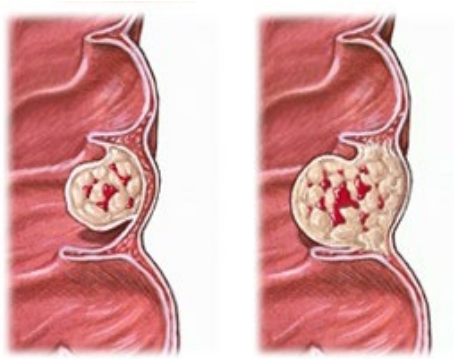
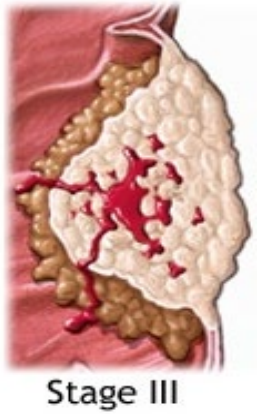
Colon Cancer

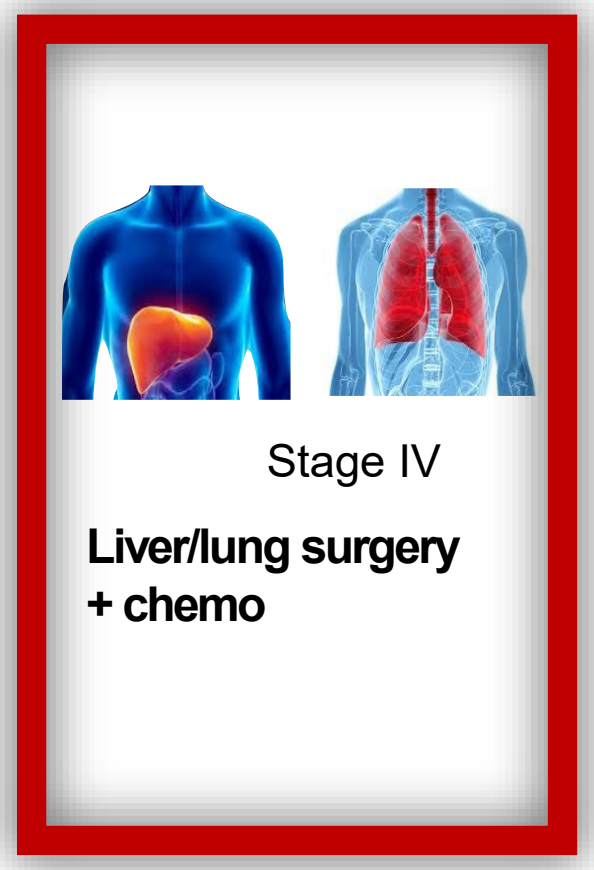
1 in 4 will get colon cancer.
Treatment depends on stage



Colon resection



Colon resection + Adj. chemo



These are the patients that die

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Colorectal cancer statistics

Colorectal cancer is the **2nd** deadliest cancer in the US

Black patients are **20%** more likely to get colorectal cancer than other groups

Black patients are **40%** more likely to die of colorectal cancer than other groups

Memorial Sloan Kettering Cancer Center

THE UNIVERSITY OF TEXAS MD Anderson Cancer Center

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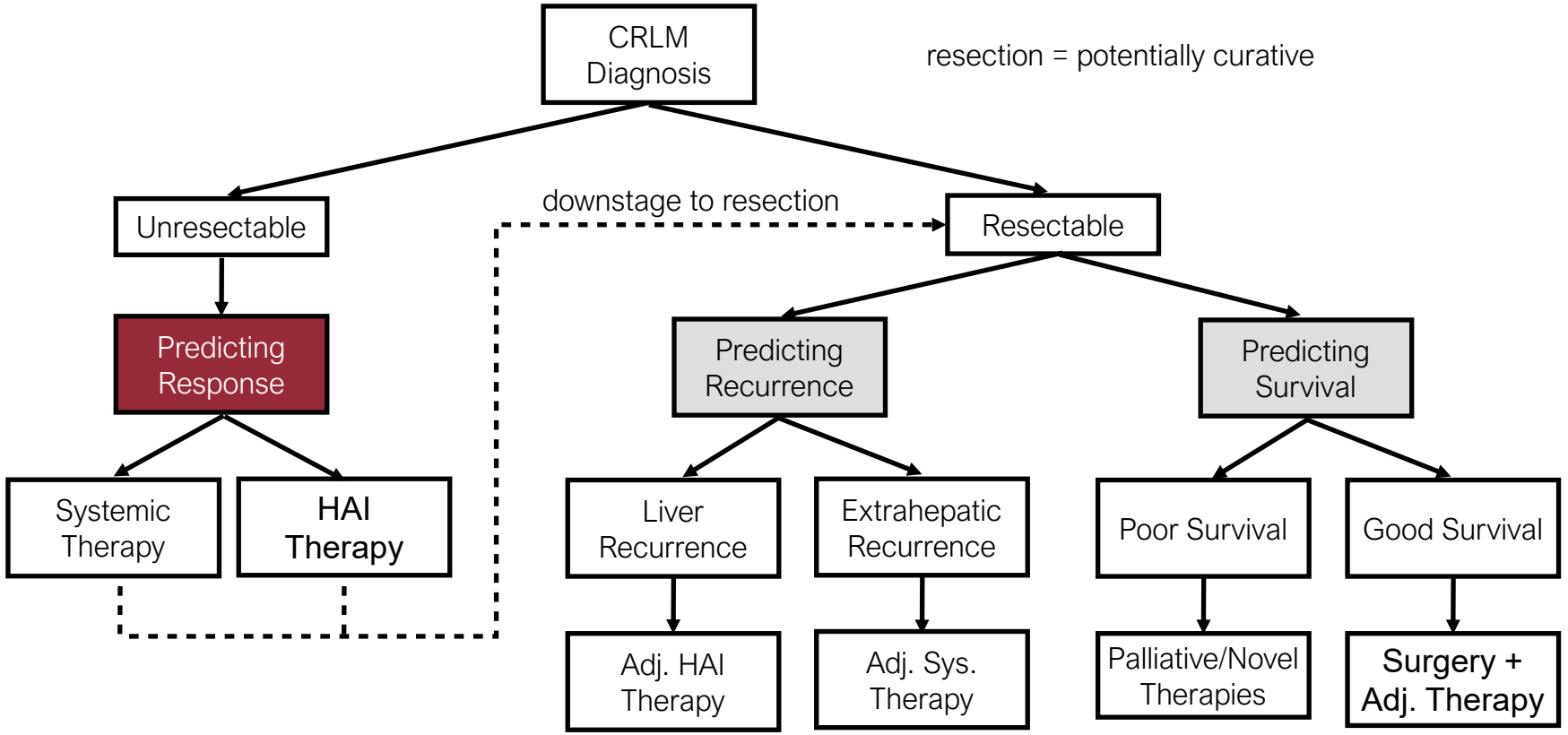
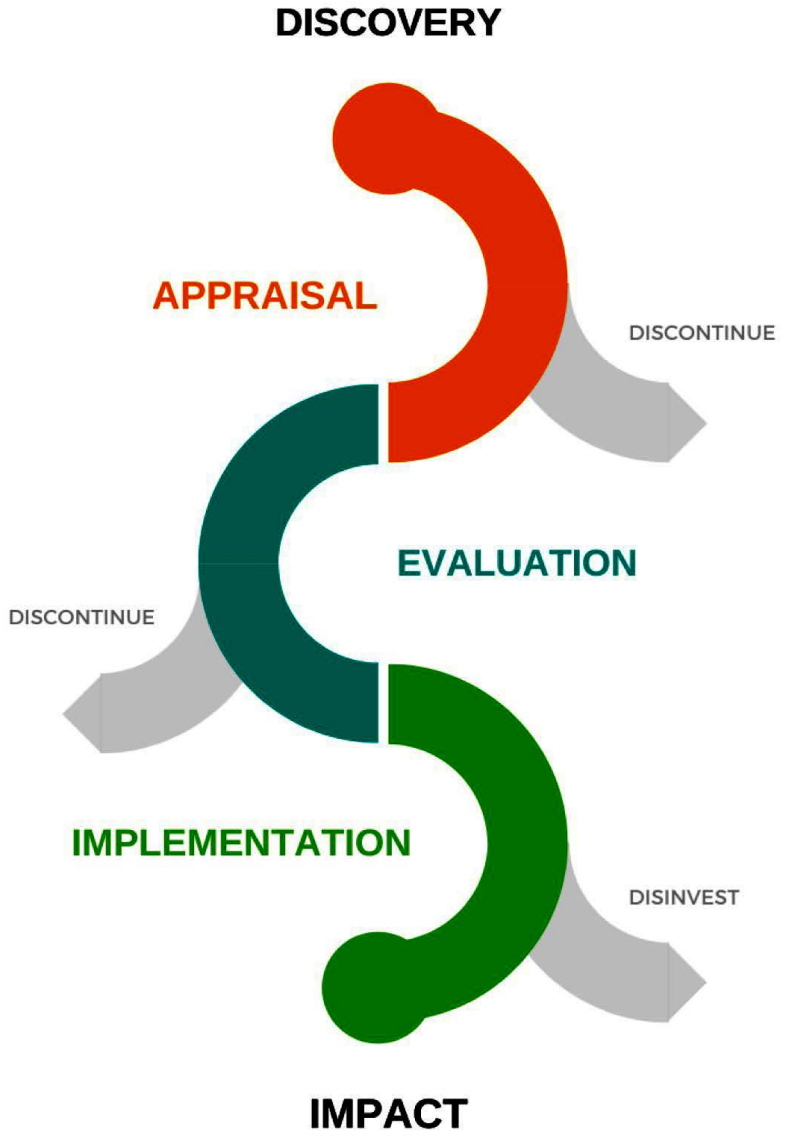
Treatment of Colorectal Liver Metastases



No known method to predict response in CRLM

Standardization of Imaging Biomarkers

- NIH R01 awarded in 2019 to develop accurate and robust imaging biomarkers for personalized treatment of colorectal liver metastases (CRLM) (PIs: Simpson - Queen's, Chun - MD Anderson, Do - Memorial Sloan Kettering)
- External validation needed (collaboration with MD Anderson)
- Scan protocol acquisition and reconstruction variation (prospective protocol)



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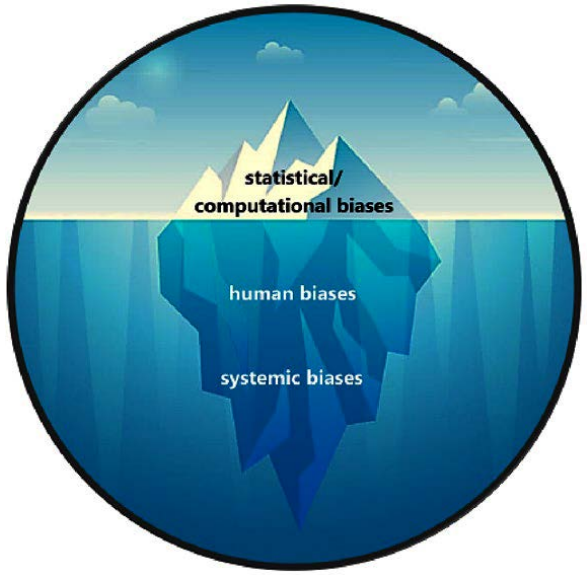
The need for ethical development of imaging biomarkers

- AI models can learn biases through direct and indirect ways
- Black patients are more likely to be harmed by bias
- Our parent grant (R01) deals with statistical biases, but more complex human and systemic biases remain undiscovered.



The challenge of AI bias (from NIST).

Schwartz et al. Towards a Standard for Identifying and Managing Bias in Artificial Intelligence. NIST Special Publication. Gaithersburg, MD. 2022.

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Research Aims

- **Aim 1:** Perform a comprehensive review of risk and race correction factors in colorectal cancer from the lens of race-based medicine.
- **Aim 2:** Train a neural network to recognize race and race surrogates from abdominal CT scans
- **Aim 3:** Develop an accessible podcast series as a primer for computational scientists and clinicians on bias in AI

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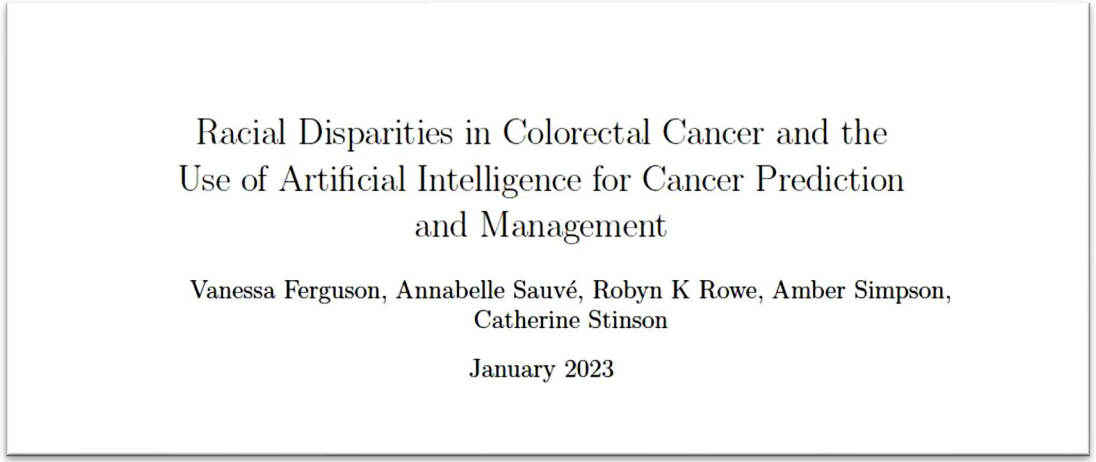
Aim 1: Perform a comprehensive review of risk and race correction factors in colorectal cancer from the lens of race-based medicine.

Strategy & Methodology:

- Review the clinical literature on colorectal cancer and its related risk factors to understand the separation of biological and socioeconomic factors and how these influence each other.
- Review potential race correction/race variable factors that are at play for Black patients



Racial Disparities in Colorectal Cancer and the Use of Artificial Intelligence for Cancer Prediction and Management

Vanessa Ferguson, Annabelle Sauvé, Robyn K Rowe, Amber Simpson, Catherine Stinson

January 2023

Status of paper: In revisions with BMC Cancer

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The Patient/Industry Trade-off in Medical Artificial Intelligence

Objective of Paper:

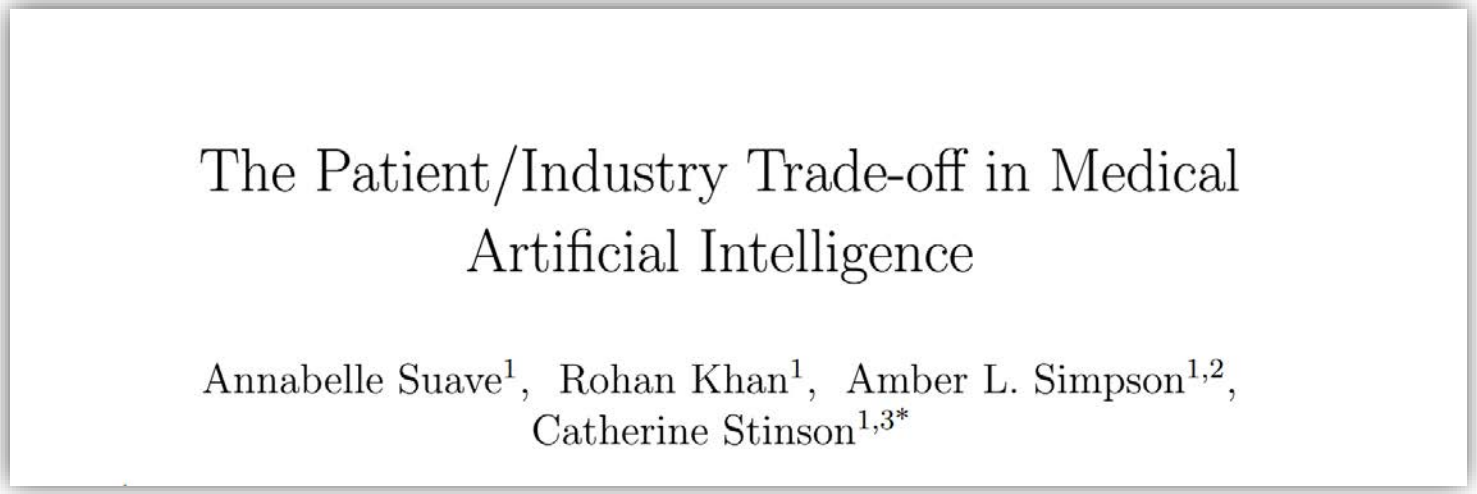
To analyze the conflict in medical AI research between providing benefits to patients against benefits to the industry. We inspect factors hampering integration of research into clinical care and propose approaches for addressing this gap.

Status:

Revisions being completed before submission

Target journal – AI and Ethics

Target submission – April 2024


The Patient/Industry Trade-off in Medical Artificial Intelligence

Annabelle Suave[1], Rohan Khan[1], Amber L. Simpson[1,2], Catherine Stinson[1,3*]

Aim 3: Develop an accessible podcast series as a primer for computational scientists and clinicians on bias in AI

Digital Cancer Twin

- Investigate the ethical, social, philosophical and technical implications of the cutting-edge AI cancer diagnostic technology.
- Available online on CFRC-FM, Apple Podcasts, Spotify, Pandora, Deezer:
  - Introduction to the Digital Cancer Twin Project
  - AI, Military Funding, and the Digital Cancer Twin
  - Race Medicine, Data Justice, and an Ethics of Artificial Intelligence
  - The Role of the Humanities in AI and Medical Research

Produced and edited by Dr. Jordan Loewen-Colón and Andrei Pora

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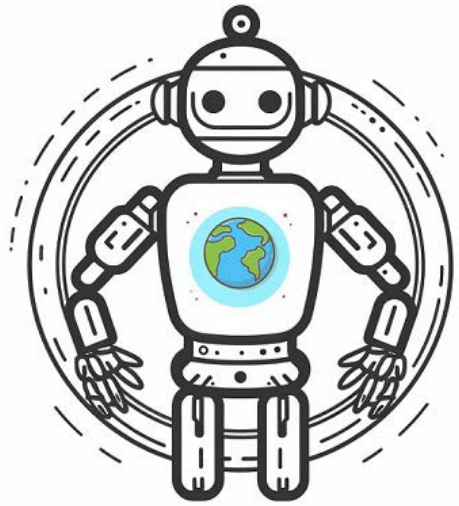
The Responsible Use of AI Podcast

- Engages multidisciplinary scholars in discussions on the implications of AI technologies and tools, and necessary considerations prior to its deployment
- Available online on CFRC-FM, Apple Podcasts, Spotify, Deezer:
  - Indigenous Data Sovereignty and Data Justice in the Age of AI
  - Implications for Data Curation in the Age of AI
  - Who is (Ac)counted for in AI?



The Responsible Use of AI Podcast

Hosted by Dr. Jordan Loewen-Colón, Vanessa Ferguson and Aakanksha Khandwaha

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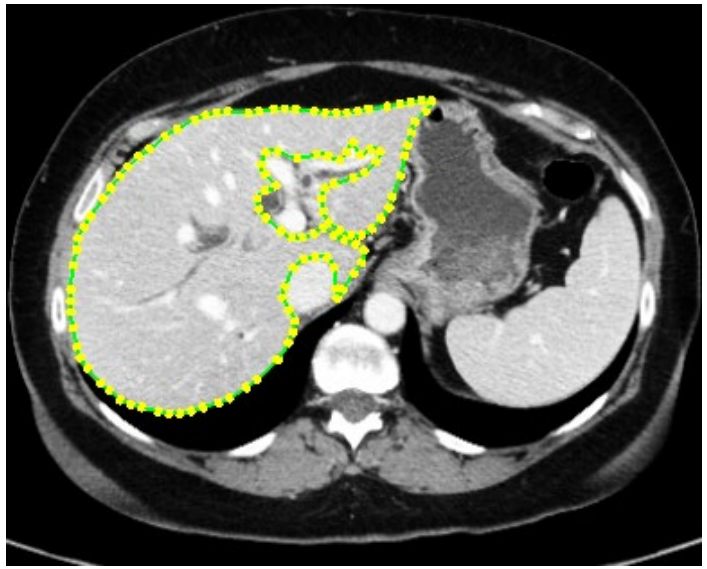
Aim 2: Train a neural network to recognize race and race surrogates from abdominal CT scans

Strategy and Methodology:

- Leverage our large consecutive series of CT scans for stage IV colorectal patients from two institutions (n=2450) assembled in the parent R01
- Taking inspiration from “Reading Race” (Banerjee et al., 2021) we will train a neural network to assess bias in the data.



Segmentation of liver CT-scan

Status:
Data from parent R01 is currently being prepared and annotated. Data is expected to be available in Summer 2024.

Banerjee et al. *Reading Race: AI Recognises Patient’s Racial Identity in Medical Images.* 2021

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Our Lab

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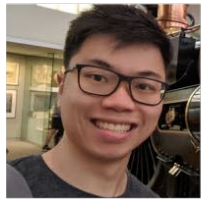
Life Sci

Alan Dimitriev
MSc - CS

Andrew Garven
MSc - DBMS



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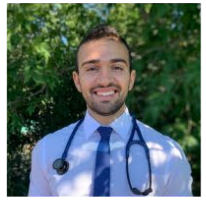

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Poulina Tran
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Jianwei Yue
PhD - CS

Lola Assad
Undergrad - CS

Lydia Elbatarny
Undergrad - CS

Ben Ravenscroft
Undergrad - CS

Mohammad Hamghalam
Post Doc

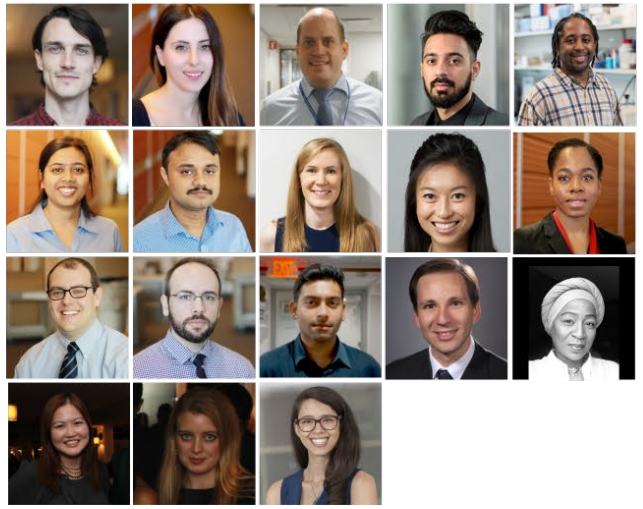
Jordan Loewen
Post Doc

Robyn Rowe
Post Doc

Jacob Peoples
AI Scientist

Vanessa Ferguson
MA - Phil

Alumni



CIHR IRSC
Canadian Institutes of Health Research / Instituts de recherche en santé du Canada

SSHRC CRSH

CYCLE FOR SURVIVAL
Memorial Sloan Kettering Cancer Center
EQUINOX

NSERC CRSNG

SAR
Society of Abdominal Radiology

AACR American Association for Cancer Research

CANADA RESEARCH CHAIRS
CHAIRES DE RECHERCHE DU CANADA

NIH NATIONAL CANCER INSTITUTE

PANCREATIC CANCER ACTION NETWORK

Thank you!

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