McGill
MACDONALD CAMPUS

Ryan Mailloux

Associate Professor
Director of the School of Human Nutrition

Professor Ryan J. Mailloux received is PhD in Biomolecular Sciences in 2008 from Laurentian University, after which he conducted his postdoctoral work at the University of Ottawa and Carleton University/Health Canada, respectively. Before joining the School of Human Nutrition at McGill University in 2019, he served as a faculty member (tenure-track) in the Department of Biochemistry at Memorial University of Newfoundland (2015-2019). He is now Director of the School of Human Nutrition at McGill. Professor Mailloux has published 94 articles on the topics of mitochondrial bioenergetics, oxidative eustress and oxidative distress, redox homeodynamics, hydrogen peroxide production and how dysfunctional bioenergetics causes metabolic disorders. He has an h-index of 42 and his work has been cited over 5600 times. More information on his research program and publications can be found here:
SCOPUS: https://www.scopus.com/authid/detail.uri?authorId=8664226100

Research and Scientific Expertise

The overarching goal of my research program is to map out the redox signaling pathways used by mitochondria to coordinate cell functions in response to changes in nutrient status. This is of fundamental importance in understanding how normal cells use H_2O_2 to regulate nutrient metabolism pathways to maintain energy balance, induce adaptive signals in response to cell stress, and trigger cell proliferation, growth and repair programs to maintain tissue health. Mitochondrial H_2O_2 signaling pathways can also be defective which can cause:

A. Metabolic disorders like fatty liver disease, which is induced by poor nutrition.
B. Cancer, since aberrant H_2O_2 production and signaling activate programs that promote oncogenesis, cancer cell survival, drug resistance and metastasis.
C. Eye diseases like cataracts through the over oxidation of lens proteins.

To this end, exploring how mitochondria use H_2O_2 for signaling has high therapeutic potential since its controlled generation can:

A. Promote liver regeneration in response to injury induced by poor nutrition or toxins (e.g., paracetamol or alcohol).
B. Identify of new chemotherapeutics that suppress the oncogenic properties of H_2O_2.
C. Develop new approaches for eye health through restoration of lens epithelial H_2O_2 generation.

The therapeutic targeting of mitochondrial H_2O_2 first requires understanding how it is generated and the mechanisms that are used to control its production. This is where my lab comes in. My research is invested in understanding:

A. How mitochondria generate H_2O_2.
B. Which enzymes produce this H_2O_2 and where does the production occur in mitochondria.
C. How mitochondria balance this H_2O_2 production with antioxidant defenses for signaling while avoiding H_2O_2 toxicity.
D. Which feedback mechanisms are used to fine tune H_2O_2 generation.
E. Which of the enzymes in mitochondria serve as the most important H_2O_2 generators for signaling.
F. What mechanisms are used to turn H_2O_2 generation up and down to elicit cell signals.

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