



Brain-to-Society Research Seminar and Convergent Innovation Panel

*Scaling-up what Metagenomics, Microbiome,
Neuroinformatics, and Multiscale Computational Models can
contribute to Convergent Innovation in Food and Health*

SPECIAL TWO-PRONG EVENT

Thursday, September 13, 2018 from 3:30 pm to 5:30 pm

Room 620, Bronfman Building, McGill University
1001 Sherbrooke Street West, Montreal

Remote Participation Information:

Zoom Web Conferencing at <https://zoom.us/j/920385425>

The first prong of this event is our Brain-to-Society Research Seminar delivered by Dr. Sharmila Mande, Chief Scientist & Head of Bio-Sciences R&D at Tata Consultancy Services.

Title: Biological Computational Models, Diet, Microbiome, and Health

Digital technologies and computational models in the biological sphere are opening new horizon for human diet and health. The diversity of microbes that inhabit our body (called ‘human microbiome’) plays critical functional roles in maintaining our health. An imbalance in this microbial community has been associated with several diseases (e.g. diabetes, obesity, cancer, lung dysbiosis, brain functioning, etc.). Therefore, it is essential to understand the composition of microbiome in healthy human in order to delineate the host-microbiome interactions. Our studies have shown that gut microbiome changes with nutritional status as well as lifestyle differences (rural/urban, ethnicity, diet). Diet plays an important role in determining the composition of the gut microbiota. Some of the microorganisms in the gut help in assimilating dietary nutrients. Such bacteria can utilize their enzymatic machinery to digest proteins, fats and carbohydrates, which are indigestible by humans. The metabolites produced by them not only modulate gastro-intestinal immunity, but also impact distal organs like lung and brain. Our analyses have shown that carbohydrate metabolizing capabilities of gut bacteria differ with geographies. The products obtained after carbohydrate digestion are consumed by other bacteria to biosynthesize beneficial short chain fatty acids. Further, studies have shown that protein metabolism and the following putrefaction by gut bacteria might be detrimental to health. These diet dependent intricate metabolic interactions within gut bacteria determine the composition of gut microbiome within an individual. Our analyses on the metabolic potential of the gut microbiome indicate interesting findings. Variations in the bacterial communities residing within us have the potential to serve as



'diagnostic biomarkers' that can predict the presence and/or stage of disease. We have utilized this to identify 'microbiome based diagnostic markers'. For example, we have successfully developed microbiome-based diagnostic biomarker that can accurately predict the risk of preterm birth at an early stage of pregnancy. Some of the results obtained from our studies towards the understanding of the above-mentioned aspects will be discussed during her talk.

The second prong of this special event is a panel discussion. Every scientific discipline and industrial sector is both impacted by and seeking to exploit genomics, microbiome, neuroinformatics, and/or multiscale computational models. These models have been made possible by digital technology development in the biological, computational, and other informational spaces. Leading scientists will be asked to present a short brief on their respective academic work and discuss how computational modeling and digital platforms for gut/microbiome modeling can advance scientific discovery that accelerate convergent innovation in food and health. These are designed with the intent to support more adaptive individual and collective choice by individuals and the supply/demand systems that define modern context and policy.

List of Panelists:

Mehmet Gumus, *Associate Professor, Operations Management; Desautels Faculty Scholar; Academic Director, Management Science Research Center, McGill University*

Nathan Yang, *Assistant Professor, Marketing, Desautels Faculty of Management, McGill University*

Bärbel Knäuper, *Director, Health Psychology Lab, Department of Psychology, McGill University*

Shawn Brown, *Associate Director of Research Software Development, McGill Centre for Integrative Neuroscience, McGill University*

Alain Dagher, *Associate Professor, Neurology & Neurosurgery, McGill University*

David Bujold, *Bioinformatics Manager, Epigenomic Data Coordination Centre (EDCC) & GenAP, McGill University*

Daiva Nielsen, *Assistant Professor, School of Human Nutrition, McGill*

Stan Kubow, *Associate Professor, School of Human Nutrition, McGill University*

Jennifer Ronholm, *Assistant Professor, Food Science and Agricultural Chemistry, McGill University*



BIO SKETCHES

BtS Research Seminar Presenter:

Sharmila Mande, *Chief Scientist and Head, Bio Sciences R&D, TCS Innovation Labs, Tata Consultancy Service Ltd.*

Dr. Sharmila Mande, a Chief Scientist at TCS Research, has more than 32 years of research experience in Life Sciences domain. She received her PhD degree in the year 1991 in Physics from Indian Institute of Science (IISc), Bangalore. She had her post-doctoral training at University of Groningen, The Netherlands and University of Washington, Seattle, USA. After returning to India, she continued her research at Institute of Microbial Technology (IMTech) and Post Graduate Institute of Medical Education and Research (PGIMER) in Chandigarh, before joining TCS in 2001 to start TCS' Life Sciences R&D activities. Her main areas of research include microbiome analytics, biomarker discovery for early diagnosis of diseases/disorders, algorithm development for analyzing large scale biological data and applying the same to understand human health. She has a number of projects in collaboration with several renowned National/International academic institutes as well as hospitals. She has published several papers in international journals and has delivered talks in many International and National conferences. She also has a number of patented algorithms and software solutions.

Invited Panelists:

Mehmet Gumus, *Associate Professor, Operations Management; Desautels Faculty Scholar; Academic Director, Management Science Research Center, McGill University*

Dr. Mehmet Gumus is Associate Professor of Operations Management at the Desautels Faculty of Management at McGill University. He joined McGill in 2007 from the University of California at Berkeley where he completed his Ph.D. in Industrial Engineering and Operations Research and M.A. in Economics. In his research, Dr. Mehmet Gumus explores the impact of customer behavior and information asymmetry on supply chain management, dynamic pricing, and risk management. His papers are accepted for publication in Management Science, Operations Research, Manufacturing and Service Operations Management, Marketing Science and Production and Operations Management.

Nathan Yang, *Assistant Professor, Marketing, Desautels Faculty of Management, McGill University*

Nathan Yang's main research interests are in big data and machine learning, health and wellness, behavioral science, retail, and empirical industrial organization. Much of his earlier work aims to gain a better understanding about market expansion strategies in various retail sectors (e.g., convenience stores, fast food restaurants, fast casual restaurants), whereby market expansion is a key instrument to grow a retailer's brand, and ultimately, sales. In addition to retailer expansion strategies, he has worked on (or is currently working on) projects that focus on various aspects of customer relationship management in a diverse set of industries, including appliances, bike sharing, car rentals, electronic health platforms, fast fashion, loan markets, social media, large international commercial weight loss programs, mobile weight loss apps, and video games. His most recent research attempts to blend together behavioral science, big data, and machine learning to help nudge people towards healthier lifestyles.

**Shawn Brown**, *Associate Director of Research Software Development, McGill Centre for Integrative Neuroscience, McGill University*

Dr. Brown joined McGill University in 2017 as the Associate Director of Research Software Development at the McGill Centre of Integrative Neuroscience at the McGill Neurological Institute and is an expert on high-performance computing and computational simulation. He has over 25 years of experience in developing software to support the use of high-performance computing for research in areas such as chemistry, bioinformatics, and public health. His research interests are in how agent-based modeling and other computational techniques can be used to provide decision support in public health and chronic disease. Prior, he was the Director of Public Health Applications at the Pittsburgh Supercomputing Center, Assistant Professor of Biostatistics at the University of Pittsburgh Graduate School of Public Health, and Research Associate at Q-Chem, Inc. He received his PhD. from the University of Georgia in 2001 in theoretical quantum chemistry and has authored over 100 peer-reviewed publications.

Alain Dagher, *Associate Professor, Neurology & Neurosurgery, McGill University*

Dr. Dagher received his MD from the University of Toronto in 1989. He completed a residency in neurology at McGill University and a fellowship in movement disorders and brain imaging at the Hammersmith Hospital. He has been an attending neurologist at the Montreal Neurological Institute since 1997. His clinical specialty is movement disorders, with a focus on Parkinson's Disease. His research aims at understanding the function of the basal ganglia, with a particular emphasis on appetitive behaviours. This involves studying how we learn about rewards and punishments, and become motivated to engage in reward-seeking behaviour. The two main techniques used are positron emission tomography (PET) targeting the dopamine system, and functional magnetic resonance imaging (fMRI). The research focusses on Parkinson's Disease, stress, drug addiction (notably cigarette smoking), pathological gambling, and obesity. Dr. Dagher is funded by CIHR, FRSQ, NIDA, the Parkinson Society of Canada, the Institute for Research on Pathological Gambling and Related Disorders, and Unilever PLC.

David Bujold, *Bioinformatics Manager, Epigenomic Data Coordination Centre (EDCC) & GenAP, McGill University*

David works in Guillaume Bourque's lab on software solutions in bioinformatics for organizing, visualizing and analyzing datasets produced by large-scale projects such as the International Human Epigenome Consortium (IHEC), which maps human epigenomes for a broad spectrum of cell types and diseases. He is also involved in the development of GenAP ([link is external](#)), a platform that leverages Compute Canada infrastructure to make bioinformatics analysis more accessible to non-bioinformaticians, and reduces data processing bottlenecks.

Daiva Nielsen, *Assistant Professor, School of Human Nutrition, McGill University*

Daiva Nielsen completed her graduate work at the University of Toronto in the areas of nutrigenomics and personalized nutrition. She went on to conduct postdoctoral research in translation genomics at Brigham and Women's Hospital and Harvard Medical School in Boston, MA, USA, where she was involved in some of the first clinical trials aimed at evaluating the medical, behavioural and economic outcomes of incorporating genomic sequencing into medical practice. Dr. Nielsen's training background has provided her with skills in dietary assessment, behaviour modification, genomics and knowledge translation. Her research goals include utilizing



genomic information to design tailored strategies for prevention of cardiometabolic diseases, and ensuring optimal knowledge translation to health professionals.

Stan Kubow, *Associate Professor, School of Human Nutrition, McGill University*

Stan Kubow obtained his PhD in 1984 from University of Guelph after obtaining undergraduate and graduate degrees at McGill University and University of Toronto. He carried out postdoctoral studies at University of Guelph and University of Toronto from 1984-1987 prior to joining the School of Dietetics and Human Nutrition at McGill University as an Assistant Professor in 1987. He has been an Associate Professor since 1993 and also served as Acting Director from 1993-1994. He serves on the editorial boards of Journal of Lipids, Nutrition and Medicine and Journal of Nutrition and Metabolism. He participates as a grant panel member of Tri-council funding agencies including Canadian Institutes of Health Research (CIHR) and the Natural Sciences and Engineering Research Council of Canada (NSERC). He is recruited regularly by industry to support nutritional, toxicological, biochemical and phytochemical research investigations via grant and research contract support.

Jennifer Ronholm, *Assistant Professor, Food Science and Agricultural Chemistry, McGill University*

Dr. Ronholm obtained her BSc in microbiology from the University of Waterloo and Doctoral degree in microbiology from the University of Ottawa. Her research area involved the study of bacterial surface proteins which would allow the identification of particularly virulent strains of *Listeria monocytogenes* and *Salmonella*. Her first post-doctoral fellowship was with the Canadian Astrobiology Training Program where her research focused on using next-generation sequencing to investigate how organisms survive in extreme cryoenvironments such as the Canadian high arctic. Dr. Ronholm then held a Vising Fellowship with Health Canada where she focused on developing genomics based techniques for evaluating and improving the safety of several food products, particularly seafood. Dr. Ronholm's research interests include using the latest next-generation sequencing techniques to study how the microbiome of food-producing animals affects food quality, as well as how the microbiome of the food we eat affects human health.

Bärbel Knäuper, *Director, Health Psychology Lab, Department of Psychology, McGill University*

Dr. Knauper is the James McGill Professor of Health Psychology in the Department of Psychology at McGill University. Her research focuses on determinants of health self-management and health behaviors. She develops theory-based behavioral intervention programs in the areas of eating, physical activity, and medication adherence.