Sensation, Reward, and Gut-Brain Pathways

By Ivan de Araujo

Mount Sinai Hospital, *New York*

With High-Level Panel of Leaders in Science, Technology, On-the-Ground Action, and Policy

Wednesday, April 5, 2023 | 11 AM to 1 PM EST (2 hours in duration)

For Remote Participation, please register *HERE*

ABSTRACT: Gastrointestinal organs convey mixed messages to the central nervous system, which range from mechanical stretch to nutritional value. The presentation aims at addressing the question of how these multimodal signals arising from the gut may be decoded by brain neurons. In particular it describes a unique aspect of the functional neuroanatomy of food reinforcement, namely, the ability of gut nutrient sensors to directly activate the brain's subcortical reward circuitry. Activation of subcortical circuitries results in the bypassing of the cortical networks that mediate overt, conscious insights into the sensory-hedonic qualities of foods. The implications for our understanding of phenomena such as satiety and pleasure, and the conscious perception of body states, will be discussed.

PRESENTER: Ivan de Araujo Studied Philosophy and Mathematics at the University of Brasilia, followed by postgraduate studies in Artificial Intelligence at the University of Edinburgh School of Informatics. He was awarded the title of Doctor of Philosophy (DPhil) in Experimental Psychology at the University of Oxford, under the supervision of Edmund T. Rolls. After his doctorate, De Araujo held a postdoctoral research position with Miguel Nicolelis at Duke University. He then acted between 2007 and 2018 as Professor of Psychiatry at the Pierce Laboratories at Yale University. Since 2018 he has been a Professor of Neuroscience at Mount Sinai Hospital in New York.

About the series: The precision convergence series is launched to catalyze unique synergy between, on the one hand, novel partnerships across sciences, sectors and jurisdictions around targeted domains of real-world solutions, and on the other hand, a next generation convergence of AI with advanced research computing and other data and digital architectures such as PSC's Bridges-2, and supporting data sharing frameworks such as HuBMAP, informing in a real time as possible the design, deployment and monitoring of solutions for adaptive real-world behavior and context.

The McGill Centre for the Convergence of Health and Economics (MCCHE) is a virtual world network of scientist, action and policy leaders promoting the weaving of digital-powered interdisciplinary science into person-centered domain-specific solutions at scale to global challenges faced by traditional and modern economy and society worldwide. The MCCHE stimulates lasting collaborations that bridge the many divides in the market, economy, and society that are at the root of these most pressing modern challenges through collaborative of modular convergence innovation platforms.

The Pittsburgh Supercomputing Center is a joint computational research center between Carnegie Mellon University and the University of Pittsburgh. Established in 1986, PSC is supported by several federal agencies, the Commonwealth of Pennsylvania and private industry. PSC provides university, government, and industrial researchers with access to several of the most powerful systems for high-performance computing, communications, and data-handling available to scientists and engineers nationwide for unclassified research. PSC advances the state-of-the-art in high-performance computing, communications and informatics and offers a flexible environment for solving the largest and most challenging problems in computational science.

Co-Chairs:

Laurette Dubé, PhD is the founding Chair and Scientific Director of the McGill Centre for the Convergence of Health Economics. She holds the James McGill Chair of Consumer and Lifestyle Psychology and Marketing. Her work has been published in top disciplinary journals in Psychology, Management and Medicine as well as in multidisciplinary journals. She holds an MBA in finance, and a PhD in behavioural decision making and consumer psychology. During her 2020-2021 sabbatical, she is a visiting scholar at the National Research Council of Canada and at the Pittsburgh Supercomputing Center, Carnegie Mellon, USA. https://thefutureeconomy.ca/interviews/ laurette-dube

Sergiu Sanielevici, Ph.D. is Director of Support for Scientific Applications at the Pittsburgh Supercomputing Center, a joint project of Carnegie Mellon University and the University of Pittsburgh. He has served as the Deputy Director of the Extended Collaborative Support Service of the US NSF XSEDE project and as the manager of its Novel and Innovative Projects program, fostering non-traditional and interdisciplinary applications of advanced computing and data resources since 2011. He is currently the Principal Investigator of the Bridges-2 project and co-Principal Investigator of the Neocortex project at PSC. Dr. Sanielevici is a proud alumnus of McGill University (Ph.D., Physics, 1986).

Panelists:

Edmund T. Rolls is a neuroscientist with research interests in computational neuroscience, emotion, memory, vision, taste, olfaction, the control of food intake, and mental disorders. He is a Professor at the University of Warwick, UK. Professor Rolls has published more than 670 full length research papers on these topics, which are shown, with many .pdfs available including some of his books, at https://www.oxcns.org.

Pamela Reinagel is an Associate Professor of Neurobiology at UCSD. She earned her B.S. in Biology at Carnegie Mellon University and her Ph.D. in Biochemistry at Harvard University. She then switched to the field of Computational Neuroscience, training with Markus Meister at Harvard, with Christof Koch as postdoctoral fellow of the Sloan Center for Theoretical Neuroscience at Caltech, and with Clay Reid at Harvard Medical School. She started her own laboratory at UCSD in 2003. She is known for her work in neural coding and natural scene statistics, and was a pioneer in rodent visual behavior, developing one of the first high-throughput automated training and testing paradigms for rodent vision. Her current neuroscience research focuses on visual decision-making and behavioral neuro-economics in rodents; and functional dissection of parallel visual streams, including a rodent model of blindsight. In the field of philosophy of science, her research focuses on the validity of inductive inference in experimental biology, including reliability in non-confirmatory research, and non-statistical components of research rigor.

Tim Moran received his PhD in Biopsychology from Johns Hopkins University in 1982. He is currently the Paul R. McHugh Professor of Motivated Behaviors and Executive Vice Chair in the Department of Psychiatry and Behavioral Sciences at the Johns Hopkins University School of Medicine. He researches brain gut interactions in the controls of food intake and body weight and how these go awry in obesity and eating disorders. Work has focused on brain/gut peptides as feedback controls of meal size and how these interact with hypothalamic and reward systems involved in overall energy balance. He has also examined the effects of exercise on food intake and hypothalamic signaling, how gestational and early developmental factors can bias metabolic programming through epigenetic mechanisms to contribute to obesity and type II diabetes and the mechanisms through which bariatric surgery affects food intake and body weight.

Patricia Silveira is the scientific director of the Genomics and Epigenetics Pillar of the Ludmer Centre for Neuroinformatics & Mental Health, based at the Douglas Research Centre, and Associate Professor at the Department of Psychiatry at McGill University. She is the Associate Director of the Integrated Program in Neuroscience (IPN) at McGill, and a Visiting Associate Professor, Department of Paediatrics, Yong Loo Lin School of Medicine, National University of Singapore.

A pediatrician and neuroscientist, Dr Silveira's research focuses on how perinatal and early-childhood environments interact with individual differences in biological processes, shaping and modulating both health and disease risk across the lifespan, into old age. Her aim is to identify how gene networks interact with environmental adversities early in life, modifying endophenotypes (impulsivity, sensitivity to reward, executive function, food choices) that ultimately affect healthy growth and neurodevelopment, increasing an individual's risk for developing chronic metabolic diseases and psychopathologies across their lifespan.

Alain Dagher is a neurologist specializing in movement disorders and functional brain imaging. 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.

Hilke Plassmann, professor of marketing management, consumer decision making and behavioral and neuro-economics at INSEAD, is one of the pioneers in the field of decision and consumer neuroscience. Her expertise is in the understanding of how we decide and its strategic marketing implications at the intersection of neuroscience, psychology, and economics. She also studies at risk populations to help improve their decision-making abilities for example in the area of health. Her research has appeared in leading academic journals such as the Proceedings of the National Academy of Sciences of the USA, Journal of Marketing Research, Journal of Consumer Research, Journal of Consumer Psychology and Journal of Neuroscience. Hilke currently is an Associate Editor of the Journal of Consumer Research and Frontiers in Psychology Section Decision Neuroscience. Her work has received international newspaper, radio, and TV coverage and she has written several award-winning cases.