

Precision Convergence Webinar Series

Self Evidencing For Individual and Collective Agency

By Dr. Karl Friston

University College London

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

Wednesday, May 4, 2022 | 11 AM to 1 PM EST (2 hours in duration)

For Remote Participation, please register [HERE](#)

ABSTRACT: In the cognitive neurosciences and machine learning, we have formal ways of understanding and characterizing perception and decision-making; however, the approaches appear very different: current formulations of perceptual synthesis call on theories like predictive coding and Bayesian brain hypothesis. Conversely, formulations of decision-making and choice behavior often appeal to reinforcement learning and the Bellman optimality principle. On the one hand, the brain seems to be in the game of optimizing beliefs about how its sensations are caused; while, on the other hand, our choices and decisions appear to be governed by value functions and reward. Are these formulations irreconcilable, or is there some underlying information theoretic imperative that renders perceptual inference and decision-making two sides of the same coin?



PRESENTER: **Karl Friston** is a theoretical neuroscientist and authority on brain imaging. He invented statistical para-metric mapping (SPM), voxel-based morphometry (VBM) and dynamic causal modelling (DCM). These contributions were motivated by schizophrenia research and theoretical studies of value-learning, formulated as the dysconnection hypothesis of schizophrenia. Mathematical contributions include variational Laplacian procedures and generalized filtering for hierarchical Bayesian model inversion. Friston currently works on models of functional integration in the human brain and the principles that underlie neuronal interactions. His main contribution to theoretical neurobiology is a free-energy principle for action and perception (active inference). In 2000 he was President of the international Organization of Human Brain Mapping. In 2003 he was awarded the Minerva Golden Brain Award and was elected a Fellow of the Royal Society in 2006. He became a Fellow of the Royal Society of Biology in 2012, received the Weldon Memorial prize and Medal in 2013 for contributions to mathematical biology and was elected as a member of EMBO (excellence in the life sciences) in 2014 and the Academia Europaea in (2015). He was the 2016 recipient of the Charles Branch Award for unparalleled breakthroughs in Brain Research and the Glass Brain Award, a lifetime achievement award in the field of human brain mapping. He holds Honorary Doctorates from the University of Zurich and Radboud University.

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 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>



Shawn Brown, PhD is the Vice Chancellor for Research Computing at the University of Pittsburgh and the Director of Pittsburgh Supercomputing Center at the Carnegie Mellon University & University of Pittsburgh. Prior to his appointment, Dr. Brown served as the Associate Director of Research Software Development at the McGill Centre of Integrative Neuroscience at the McGill Neurological Institute. Dr. Brown 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 also focused on how agent-based modeling and other computational techniques can be used to provide decision support in public health and chronic disease.

Panelists:



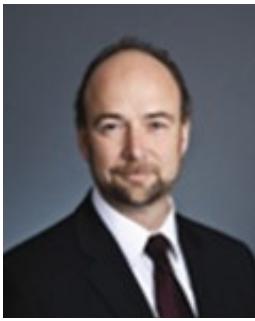
Mark Daley is the Vice-President, Research at CIFAR and a Professor in the Departments of Computer Science, Statistics & Actuarial Science, Electrical & Computer Engineering, Mathematics, Epidemiology & Biostatistics, and Biology at Western University. Mark has served as Associate Vice-President (Research) and Special Advisor to the President on Data Strategy at Western. Mark's research focuses on natural computing, computational and mathematical modelling of biological systems, artificial intelligence, and theoretical computer science. He is a faculty affiliate of the Vector Institute for Artificial Intelligence and an Associate Scientist at the Lawson Health Research Institute. He has served in a number of governance roles including chairing the board of Compute Ontario and serving on the boards of ICES and TRIUMF. He is a founding leader of the CanCOVID platform, serving on both the management and governance committees. In 2018, he was elected a Fellow of the Royal Society of the Arts (UK). In the past five years, Mark has obtained funding of over \$3.85 million (CAD) from NSERC, SSHRC, CIHR, and Industry, Science and Innovation Canada. Mark was the institutional administrative lead for the successful Canada First Research Excellent Fund proposal "BrainSCAN: Healthy Canadian Brains for Life". \$66M. He has published over 100 research articles and has been awarded U.S., European, and Chinese patents for metabolomics profiling of concussion and has US patents pending for COVID-19 diagnostics.



Konrad Kording is a German neuroscientist and professor at the University of Pennsylvania. He is known for his contributions to the fields of motor control, neural data methods, and computational neuroscience. Kording obtained both a diploma degree and a PhD in physics at ETH Zurich in 1997 and 2001, respectively. He then worked as a postdoctoral fellow at the Collegium Helveticum in Zurich and at University College London, followed by a Heisenberg Fellow position at MIT. In 2017, he joined the faculty at the University of Pennsylvania with joint appointments in the Department of Neuroscience and Department of Bioengineering. Konrad Kording's research combines experimental methods with the application of computational principles. The main principle of his work is the idea of normative models and in particular Bayesian statistics. Some of his most controversial work[citation needed] is work on predicting the future success of scientists, leading to a calculator predicting the h-index 10 years into the future. His experimental work addresses motor learning and motor control, relating these phenomena to Bayesian ideas. Most recently, he has focused on methods of analyzing neural data and methods for obtaining large neural datasets (see Brain Initiative).



Lauren N. Ross, MD, PhD is an Associate Professor in Logic and Philosophy of Science at UC Irvine. Her research concerns causal reasoning and explanation in neuroscience and biology. A significant amount of her research explores causal diversity—different types of causes, causal relationships, and causal systems present in scientific contexts. This research has focused on causal systems such as mechanisms, pathways, and cascades, and causal relationships that differ with respect to their stability, specificity, and reversibility. Her work identifies the features characteristic of these causal systems and their implications for how these systems are studied and how they behave. Ross's research has received a National Science Foundation (NSF) CAREER award, a Humboldt Experienced Researcher Fellowship, and an Editor's Choice Award at The British Journal for the Philosophy of Science.



Dr. Randy McIntosh is the Director of the Institute for Neuroscience and Neurotechnology and a Professor at the Simon Fraser University. He is also the BC Leadership Chair in Neuroscience and Technology Transfer Across the Lifespan. Dr. McIntosh completed his PhD in Psychology (Behavioral Neuroscience) at the University of Texas in December 1992). His research program involves computational modeling and brain imaging to explore changes in cognition across the lifespan and changes in the face of brain damage or disease. The program builds on an international collaboration that delivered TheVirtualBrain (thevirtualbrain.org) and integrates research efforts globally to accelerate research and translation. The goals are 1) to integrate the modeling platform into the standard workflow for clinical decision support, and 2) develop a cloud-based system where anyone can create brain models for research, clinical use, or education.



Dr. Martin Paulus, MD has been the Scientific Director and President of the Laureate Institute for Brain Research (LIBR) in Tulsa, OK since May 2014. Prior he had been a Professor in the Department of Psychiatry at the University of California San Diego and the Director of Telemental Health at the Veterans Affairs San Diego Health Care System. Dr. Paulus has a Google Scholar h-index of 101 and has published over 400 peer-reviewed manuscripts. Dr. Paulus is the Deputy Editor of JAMA Psychiatry, a Series Editor for Current Topics in Behavioral Neuroscience, and is on several editorial boards of top-tier psychiatric journals. He has served on numerous NIH and International Study Sections and is currently on the National Institute of Mental Health Board of Scientific Councilors. The goal for LIBR is to identify disease-modifying processes (DMP) based on circuits, behavior, or other levels of analysis, which “when modulated” change (1) the risk for, (2) the severity of, or (3) the recurrence of a disease such as mood, anxiety, or substance use disorder. Dr. Paulus’ program of research is to delineate DMPs and provide pathways towards the development of process-specific transdiagnostic interventions that have pragmatic utility, i.e. improve a patient’s condition faster with fewer side effects and fewer recurrences, and explanatory value, i.e. refine our understanding of the causal relationships between specific processes and a mental health condition.



Dr. 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. His clinical specialty is movement disorders, with a focus on Parkinson's Disease. His main research interest is functional brain imaging using fMRI and PET scanning to understand the function of the basal ganglia, frontal lobes and dopamine in motivated behaviors. This research has touched on the cognitive deficits in Parkinson's Disease, stress and anxiety, schizophrenia, drug addiction, obesity, and pathological gambling and other behavioral addictions.



Dr. Daniel Belsky is an Assistant Professor of Epidemiology at the Columbia University Mailman School of Public Health and the Robert N Butler Columbia Aging Center. Dr.Belsky's research sits at the intersection of public health, population & behavioral sciences, and genomics. His studies seek to understand how genes and environments combine to shape health across the life course. The goal of Dan's work is to reduce social inequalities in aging outcomes in the US and elsewhere. His research in genetic epidemiology includes polygenic score studies of the development of obesity, asthma, smoking behavior, depression, and socioeconomic risk. His work in aging has focused on the development and analysis of algorithms to quantify the process of biological aging, especially in young and midlife adults. Dr Belsky's work has received international attention, including by the Wall Street Journal, Washington Post, and Guardian newspapers, and appeared in outlets including PNAS, Nature Human Behaviour, the JAMA journals, Lancet Respiratory Medicine, and top journals in epidemiology and gerontology. Dr. Belsky is currently pursuing three related streams of research: (i) Development of methods to quantify processes of biological aging in young and midlife humans; (ii) Analysis of longitudinal cohort study and randomized trial data to identify molecular and behavioral pathways to resilience through which at-risk individuals can slow their pace of aging; and (iii) Analysis of gene-environment interplay to identify environmental factors that can be modified to reduce genetic risk for age-related disease and functional decline.