CNS*2026 Halifax

TYPE - KEYNOTE • JULY 11 • SATURDAY

K Keynote

JULY 11 • SATURDAY

5:20pm – 6:20pm	K	**Keynote 1: Bratislav Misic**	Ballroom B1

K Keynote

JULY 12 • SUNDAY

9:10am – 10:10am K **Keynote 2: Mac Shine, "The Neurobiological Basis of Consciousness"** Ballroom B1

Understanding the neural basis of consciousness requires mechanistic accounts that span multiple scales of brain organisation. Yet most existing theoretical frameworks operate at the macroscale, offering systems-level predictions without prescribing the cellular and circuit-level mechanisms that implement them. Here I argue that the multiscale architecture of the thalamocortical system offers a principled solution to this problem. Drawing on theoretical and computational work from our group, I show how the core/matrix organisation of the thalamus, in combination with the nonlinear dendritic integration properties of L5B pyramidal neurons, generates the conditions necessary for both the global state of consciousness and the specific contents of experience. A biophysical microcircuit model, extended to a corticothalamic neural mass framework, reproduces key empirical phenomena across multiple perturbation regimes - including anaesthesia, optogenetic manipulation, and pharmacological intervention - and makes predictions at the macroscale that are consistent with leading theoretical accounts.

K Keynote

JULY 13 • MONDAY

9:10am – 10:10am K **Keynote 3: Blake Richards, "Exponentiated gradients support effective learning in biologically relevant scenarios"** Ballroom B1

Computational neuroscience relies on gradient descent (GD) for training artificial neural network (ANN) models of the brain. The advantage of GD is that it is effective at learning difficult tasks. However, it produces ANNs that are a poor phenomenological fit to biology, making them less relevant as models of the brain. Specifically, it violates Dale’s law, by allowing synapses to change from excitatory to inhibitory, and leads to synaptic weights that are not log-normally distributed, contradicting experimental data. Here, starting from first principles of optimization theory, I will present an alternative learning algorithm, exponentiated gradient (EG), that respects Dale’s Law and produces log-normal weights, without losing the power of learning with gradients. We show that in biologically relevant settings EG outperforms GD, including learning from sparsely relevant signals and dealing with synaptic pruning. Altogether, our results show that EG is a superior learning algorithm for modelling the brain with ANNs.

K Keynote

JULY 14 • TUESDAY

2:10pm – 3:20pm	K	**Keynote 4: Stephanie Jones (Brown University), "Uncovering the Mechanism and Meaning of EEG/MEG Measured Brain Dynamics with the Human Neocortical Neurosolver Software"** Electro- and magneto-encephalography (EEG/MEG) are the leading methods to non-invasively record human brain dynamics with millisecond temporal resolution. However, it can be extremely difficult to infer the underlying cellular and circuit level origins of these macro-scale signals, limiting their use for a mechanistic understanding information processing and cognition. To address this need, we developed the Human Neocortical Neurosolver (HNN: https://hnn.brown/edu), a user-friendly neural modeling tool designed for multiscale thalamocortical interpretation of human E/MEG signals. I will give an overview of the theory behind the development of HNN, discuss some of the challenges and opportunities in its development, and demonstrate its use in uncovering the mechanisms and meaning of human brain dynamics in health and disease.
		Ballroom B1