Department of Applied and Computational Mathematics and Statistics Colloquium

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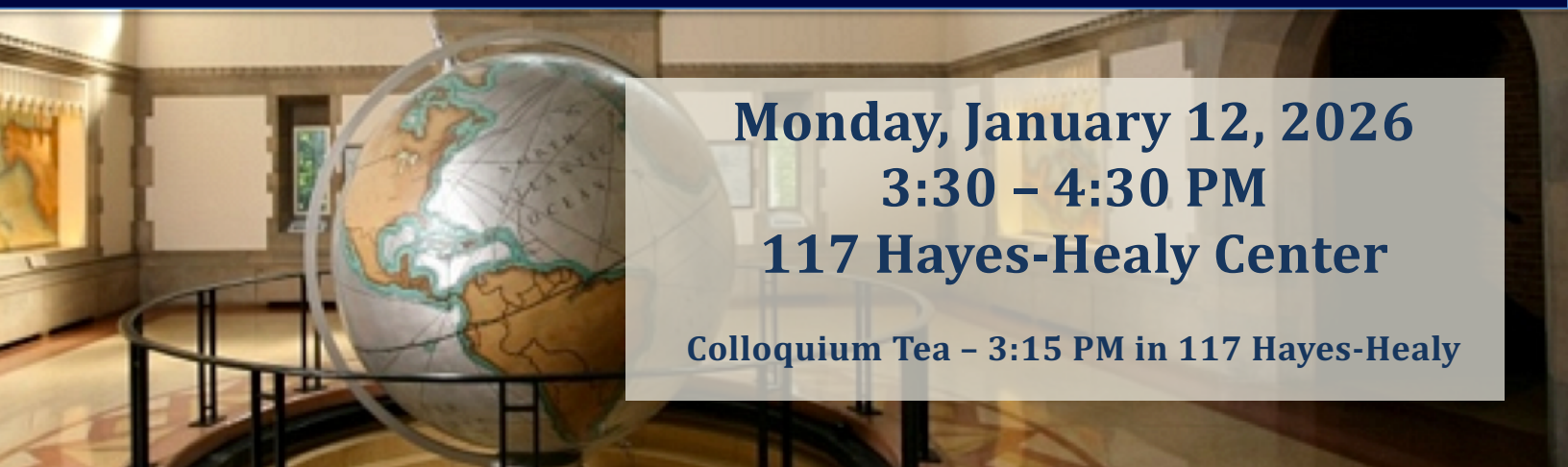
Developing and Testing Normative Theories of Synaptic

Developing rigorous theoretical models of the neural mechanisms of learning has long been a priority for the neuroscience community, due to the central importance of learning to human experience. However, while learning in artificial neural networks is governed by human-engineered optimization algorithms, the computational mechanisms underlying learning in the brain are much less clear. In this talk, I will discuss my work on normative theories of synaptic plasticity, which uses mathematical tools to explain how local synaptic changes in neural circuits can collectively produce adaptive phenomena of behavioral importance to an organism. After introducing these theories, I will discuss my recent efforts to improve upon and experimentally validate them. In the process, I will show how these theories may have widespread implications for our understanding of cognitive phenomena, ranging from the hallucinatory effects of classical psychedelics to animals' ability to adaptively control brain-computer interfaces.



Monday, January 12, 2026
3:30 – 4:30 PM
117 Hayes-Healy Center

Colloquium Tea – 3:15 PM in 117 Hayes-Healy