BIOENGINEERING
Spring 2021 Seminar

Date: **Thursday, February 18, 2021**
Time: **12:00 pm - 1:00pm**
Location: **Virtual**
Join Zoom Meeting
https://gmu.zoom.us/j/98805494005?pwd=M1A2R1BaSEdqa2hhOUltTE5YeWxtdz09

Meeting ID: 988 0549 4005 Passcode: 454698

Claudia Clopath, Ph.D.

Biography: Professor Claudia Clopath is based in the Bioengineering Department at Imperial College London. She is heading the Computational Neuroscience Laboratory. Her research interests are in the field of neuroscience, especially insofar as it addresses the questions of learning and memory. She uses mathematical and computational tools to model synaptic plasticity, and to study its functional implications in artificial neural networks. Prof. Clopath holds an MSc in Physics from the EPFL and did her PhD in Computer Science under Wulfram Gerstner. Before joining Imperial College, she did postdoctoral fellowships in neuroscience with Nicolas Brunel at Paris Descartes and in the Center for Theoretical Neuroscience at Columbia University. She published highly cited articles in top journals such as Science and Nature, has given dozens of invited talks and keynotes around the world, and received various prizes such as the Google Faculty Award in 2015.Her research interests are in the field of neuroscience, especially insofar as it addresses the questions of learning and memory. She uses mathematical and computational tools to model synaptic plasticity, and to study its functional implications in artificial neural networks.

Title: **Theory of Neural Perturbome**

Abstract: To unravel the functional properties of the brain, we need to untangle how neurons interact with each other and coordinate in large-scale recurrent networks. One way to address this question is to measure the functional influence of individual neurons on each other by perturbing them in vivo. Application of such single-neuron perturbations in mouse visual cortex has recently revealed feature-specific suppression between excitatory neurons, despite the presence of highly specific excitatory connectivity, which was deemed to underlie feature-specific amplification. Here, we studied which connectivity profiles are consistent with these seemingly contradictory observations, by modeling the effect of single-neuron perturbations in large-scale neuronal networks. Our numerical simulations and mathematical analysis revealed that, contrary to the prima facie assumption, neither inhibition dominance nor broad inhibition alone were sufficient to explain the experimental findings; instead, strong and functionally specific excitatory–inhibitory connectivity was necessary, consistent with recent findings in the primary visual cortex of rodents. Such networks had a higher capacity to encode and decode natural images, and this was accompanied by the emergence of response gain nonlinearities at the population level. Our study provides a general computational framework to investigate how single-neuron perturbations are linked to cortical connectivity and sensory coding and paves the road to map the perturbome of neuronal networks in future studies.