

## **Inferring learning rules in cortical circuits**

By Nicolas Brunel

Understanding the mechanisms of learning and memory is one of the major challenges in neuroscience. The dominant theory holds that information about sensory inputs is stored in cortical circuits thanks to synaptic plasticity. In spite of decades of research, the exact rules governing how synapses change as a function of the activity of pre- and post-synaptic neurons remain the subject of debate. In this talk, I will present two novel approaches for investigating the mechanisms of learning and memory. The first consists in inferring a learning rule from in vivo data, using experiments comparing the statistics of responses of neurons to large sets of novel and familiar stimuli. The second consists in exploring the consequences of an information optimization principle on the statistics of synaptic connectivity. I will show how methods from statistical physics can be used to characterize the statistics of connectivity in networks that optimize information storage, and compare the theoretical results with available data.