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Maps in the Brain: encoding spatial information in neuronal activity

The nervous system is, without hesitation, one of the most complex structures known to man. Neurons, the key structural elements of the nervous system, are cells specialized in processing and storing information, and the biophysical mechanisms exploited by neurons to fulfill these tasks are often sophisticated and ingenious.

In this talk I will explore in detail one important problem in theoretical neuroscience: the encoding and processing of spatial information in the hippocampus, a brain region part of the limbic system with an important role in spatial memory/learning and navigation. It is known that when a rat or mouse moves around in an environment, neurons in its hippocampus become strongly active only at specific locations of the environment. Collectively, these space encoding neurons provide a cognitive map of the animal's location. I will present recently published work by our group where we use detailed biophysical models of neuronal dynamics to better understand some of the key mechanisms related to spatial information encoding in the hippocampus.