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Thursday, April 19th, 2012
15h15, Room BC01

Computational Neuroscience Seminar

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Population encoding for dynamically changing stimuli

The range of natural inputs encoded by a neuron often exceeds its dynamic range. To overcome this limitation, neural populations divide their inputs among different cells classes, and adapt by shifting their dynamic range. I will describe that the dynamic behavior of retinal ganglion cells is divided into two opposing forms of short-term plasticity in different cell classes. One population of cells exhibits sensitization—a persistent elevated sensitivity following a strong stimulus. This newly observed dynamic behavior compensates for the information loss caused by the known process of adaptation occurring in a separate cell population. The two populations divide the dynamic range of inputs, with sensitizing cells encoding weak signals and adapting cells encoding strong signals. This coordination of dynamic ranges conforms to a model that maximizes the information the two populations provide about the input given noise and a metabolic constraint. Finally, using a model of sensitization and experimental data, I will describe that adapting inhibition underlies sensitization. By receiving a negative version of the adapting response, sensitizing cells predictively increase their sensitivity during the time when adapting cells are the most likely to fail to encode their inputs. By coordinating the properties of two populations of cells the retina maintains the ability to respond when stimulus statistics change