Colloquium

Differential Resilience to Perturbation of Circuits with Similar Performance

Eve Marder
Brandeis University

Host: Maximilian Jösch

Experimental work on the crustacean stomatogastric ganglion (STG) has revealed a 2-6 fold variability in many of the parameters that are important for circuit dynamics. Theoretical work shows that similar network performance can arise from diverse underlying parameter sets. Together, these lines of evidence suggest that each individual animal, at any moment in its life-time, has found a different solution to producing “good enough” motor patterns for healthy performance in the world. This poses the question of the extent to which animals with different sets of underlying circuit parameters can respond reliably and robustly to environmental perturbations and neuromodulation. We use both experimental and computational methods to study the effects of temperature, pH, high K+ concentrations, and neuromodulation on the networks of the STG from the crab, Cancer borealis. While all animals are remarkably robust and reliable to substantial perturbations, extreme perturbations produce "crashes". These crashes vary substantially across the animal and in models with different underlying parameter differences. The idiosyncratic nature of the crashes provides heuristic insight into the diverse nature of individuals to extreme perturbations. Moreover, models of homeostatic regulation of intrinsic excitability give insight into the kinds of mechanisms that could give rise to the highly variable solutions to stable circuit performance. The underlying parameter differences across the animals in a population and their differences in crash behavior provide a necessary substrate for evolution.

Monday, September 16, 2019 04:00pm - 05:00pm
Raiffeisen Lecture Hall, Central Building

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