The impact of timescales on the control and patterning of neural bursting

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Neuronal bursting is a rhythmic dynamic phenomenon in which cells generate rapid successions of action potentials, or bursts, in alternation with sustained non-spiking or silent phases. A variety of bursting patterns have long been understood based on fast-slow decomposition, in which slow dynamics is superimposed on the bifurcation structure of a fast subsystem. Although many models and parameter sets within models can produce qualitatively similar burst patterns, there are details relating to the robustness of these patterns and their quantitative properties that remain under-appreciated and even unexplored. In this talk, I will review the standard fast-slow decomposition analysis of bursting dynamics. I will then go on to present new results about how which components are present in a model, and the timescales on which these components evolve, impact robustness of burst patterns to parameter variations. Finally, I will discuss the dynamic mechanisms underlying a non-standard ramping burst pattern, which also depends on the presence of dynamics on an appropriate intermediate timescale.

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