Abstract View

EXPERIMENTAL CHARACTERIZATION OF SINGLE-NEURON SPIKE-TIME PATTERNS.

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Cortical cells produce reliable patterns of spike times in response to stereotyped fluctuating injected current. Within a population of cells driven by a common sensory input, precise spike patterns persist despite differences in membrane properties, and the addition of "extra" output spikes (Reinagel & Reid 2002, J. Neurosci 16, 6837-41). We investigated the robustness of output spike patterns to controlled changes in the stereotyped input, the addition of extra spikes, and variations in the initial conditions of the neuron. Pyramidal cells in rat prefrontal cortical slice were injected with a constant depolarizing current to induce firing; a stereotyped aperiodic fluctuating current was superimposed. On different trials we varied the amplitude of the fluctuating current, induced extra spikes with brief depolarizing pulses, and varied the voltage of the initial state.

For small changes in the fluctuating current amplitude the times of individual output spikes varied slowly or remained constant. For sufficiently large changes, spike times made abrupt transitions and the number of spikes in a trial changed as a spike was added or deleted from the spike train. In the vicinity of these spike-time transitions the reliability of spike events decreased dramatically. Inducing additional output spikes changed the output spike pattern within 100 ms. Perturbing the initial conditions of the neuron changed the initial spike pattern but within one or two spikes the original pattern re-emerged.

Robust spike-time patterns in response to stereotyped input are consistent with motifs of repeated multi-neuronal patterns (Cossart et al 2003, Nature 423, 283-288).

[spike-time attractor, stability, bifurcation, frozen noise]
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