WORKSHOP
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Oscillatory circuits underlying the retinal detection of temporal patterns

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Abstract

Isolated retinas subjected to periodic patterns of dark flashes in the range 6-20 Hz can respond to an omitted flash by emitting ganglion cell spikes after a fixed delay. We explore the mechanism underlying this omitted stimulus response (OSR) with emphasis on the function of ON bipolar cells. We develop an adaptive LRC oscillator model whose inductance is determined by transient calcium concentration in the ON bipolar cell terminal. This in turn adjusts the resonant frequency to approximately match the stimulus frequency, producing a fixed latency from omitted flash to OSR, as observed in experiments. We also compare model predictions and empirical observations in terms of OSR size and latency as flash numbers and durations vary.

This is joint work with Juan Gao, Greg Schwartz, and Michael Berry II.