Hold your pauses: external globus pallidus neurons respond to behavioural events by decreasing pause activity.

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Abstract:

Awareness of its rich structural pathways has earned the external segment of the globus pallidus (GPe) recognition as a central figure within the basal ganglia circuitry. Interestingly, GPe neurons are uniquely identified by the presence of prominent pauses interspersed among a high-frequency discharge rate of 50-80 spikes/s. These pauses have an average pause duration of 620 ms with a frequency of 13/min, yielding an average pause activity (probability of a GPe neuron being in a pause) of \( \frac{620 \times 13}{60 \times 1000} = 0.13 \). Spontaneous pause activity has been found to be inversely related to arousal state. The relationship of pause activity with behavioural events remains to be elucidated. In the present study, we analysed the electrophysiological activity of 200 well-isolated GPe pauser cells recorded from four non-human primates (Macaque fascicularis) while they were engaged in similar classical conditioning tasks. The isolation quality of the recorded activity and the pauses were determined with objective automatic methods. The results showed that the pause probability decreased by 9.09 and 10.0%, and the discharge rate increased by 2.96 and 1.95%, around cue and outcome presentation, respectively. Analysis of the linear relationship between the changes in pause activity and discharge rate showed \( r(2) = 0.46 \) and \( r(2) = 0.66 \) upon cue onset and outcome presentation, respectively. Thus, pause activity is a pertinent element in short-term encoding of relevant behavioural events, and has a significant, but not exclusive, role in the modulation of GPe discharge rate around these events.

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