
Subthalamic Nucleus Encodes Appetitive and Aversive Reinforcers, Execution Error and Reward Prediction Error, in Rat

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Résumé

Subthalamic nucleus (STN) is a core of the basal ganglia, a set of subcortical structures traditionally considered for their role in the control of movement, but also involved in cognitive and motivational processes. Recent electrophysiological studies have shown that neurons in the STN responded differently to predictive indices and to the obtaining of various rewards (water, sugar and cocaine). However, these studies focused on reinforcing agents having only a positive expected value. It was therefore important to continue these studies by testing the responses of STN on the presentation of aversive reinforcing agents. We therefore investigated the activity of STN during the presentation of quinine, a bitter compound whose consumption is avoided by rats.

To do this, we conditioned 10 rats to perform a reaction time task subscribed for two different rewards. The rats were first conditioned to work for two concentrations of sucrose (4% and 32%). We recorded the activity of single neurons in the STN depending on the concentration of sucrose in the presentation of the light cue, of the obtaining reward and in incorrect trials. The recordings were made while the sucrose solution (4%) was then replaced by quinine. To test the ability of neurons of the STN to intervene in the reward prediction error, we also recorded STN neurons while the announced reward was not delivered in 20% of cases.

Our results show that the activity of STN neurons could be redistributed depending on the nature of the reinforcing agents available. They also showed that the STN is able of encoding information on quinine. And finally, they suggest that the STN shares, in part, the encoding function of the reward prediction error of dopaminergic neurons. These results consolidate the role of STN in motivation, and provide additional insight on how it treats motivational information.

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