Abstract View

DOPAMINE D1 RECEPTOR ACTIVATION SELECTIVELY ENHANCES SUSTAINED SYNAPTIC INPUTS TO PREFRONTAL CORTEX NEURONS.

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Dopamine acting on D1 receptors enhances sustained delay- and response-related activity of PFC neurons on working memory tasks. Recent detailed computer simulations suggest that NMDA mediated currents are critical for the maintenance of such sustained activity patterns (Durstewtiz et al. 2000). The present study examined the modulation of glutamatergic currents by D1 agonists. D1 agonists increased post-synaptic NMDA currents evoked synaptically or by puffing NMDA. In contrast, D1 agonists had a slight inhibitory effect on non-NMDA EPSCs due to a small reduction in release probability as measured using minimal stimulation and the MK-801 blocking function. We also studied the effects of D1 agonists on responses to 20 Hz trains since PFC neurons show sustained discharges in this range during the delay-period of working memory tasks. When 20 Hz trains of stimuli were given, the control response decayed due to synaptic depression. D1 agonists counteracted this effect by making the response settle at more depolarized steady-state levels, enhancing later responses in the train. This effect was blocked by APV suggesting that it was mainly due to the nonlinear temporal summation of the larger NMDA EPSPs in the presence of D1 agonists. It was also reproduced in a compartmental model when synaptic depression and G_{NMDA} was shifted in accordance with in vitro data. By producing a more depolarized steady-state response to input trains, D1 receptor activation may bias networks of PFC neurons to receive a relatively constant source of excitatory synaptic drive necessary to maintain sustained activity patterns.

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