A role of NMDA receptor-dependent burst firing of midbrain dopamine neurons in adaptive decision-making

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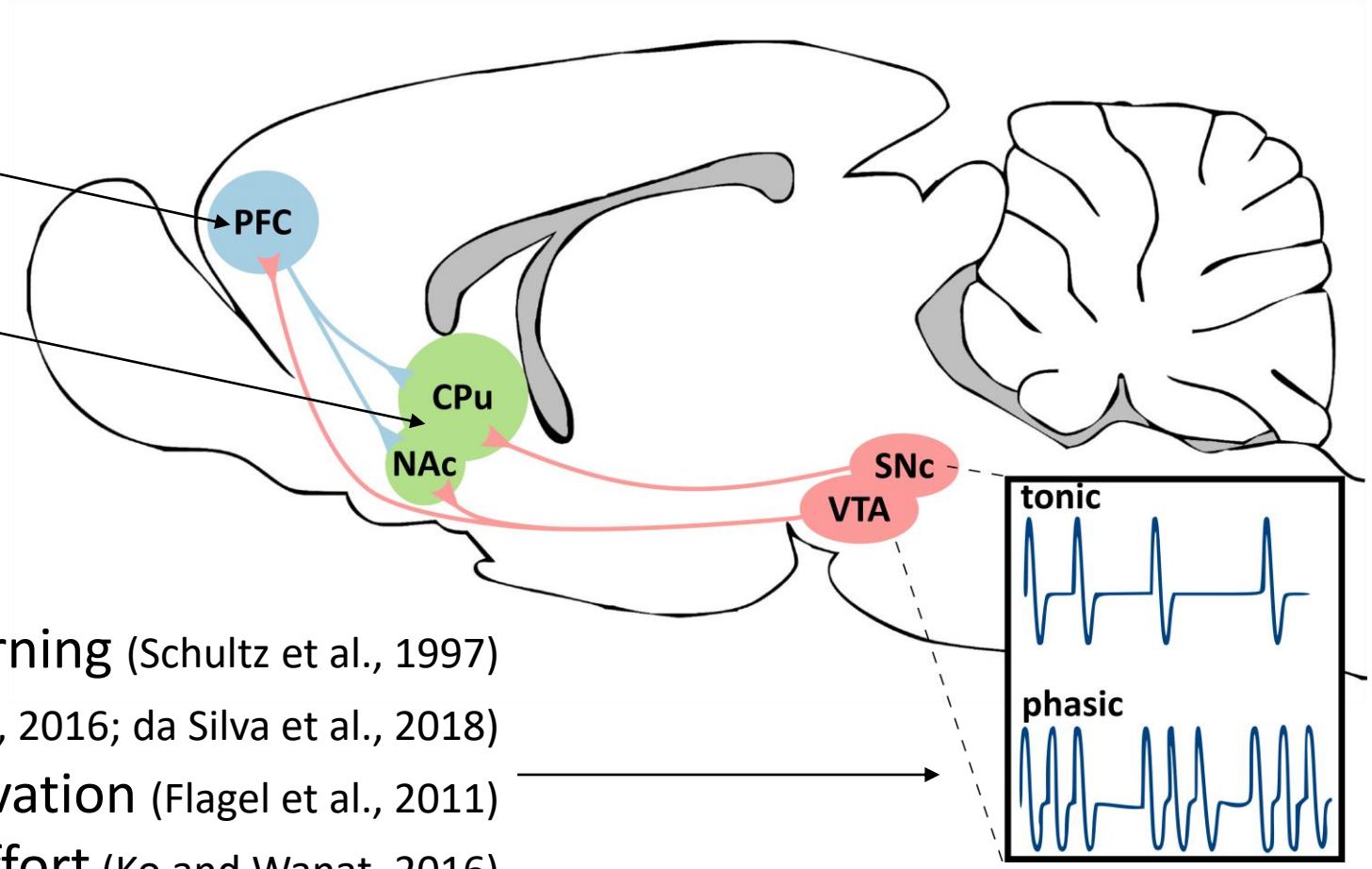
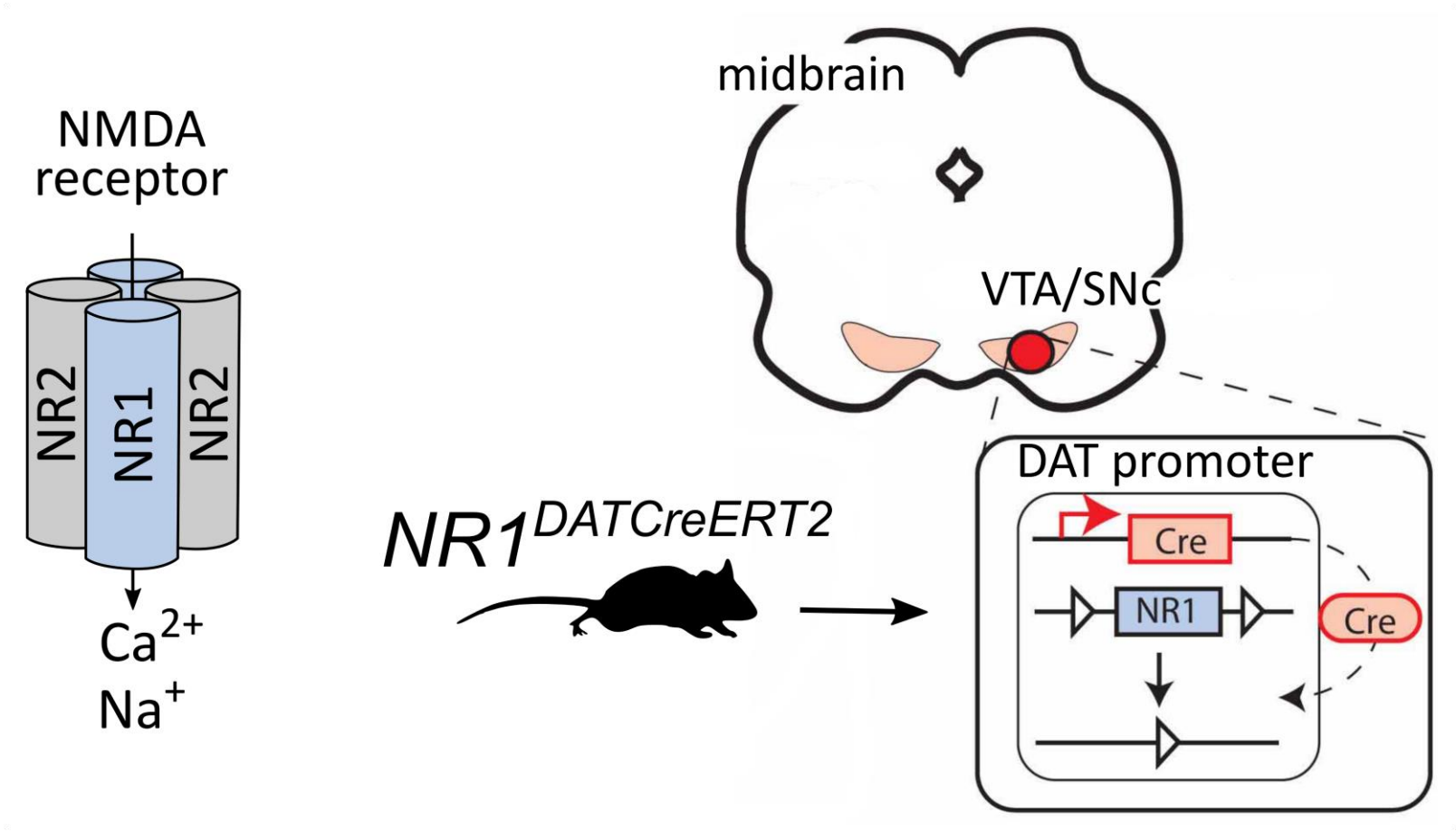
Dopamine and decision-making

action valuation
action selection
outcome evaluation

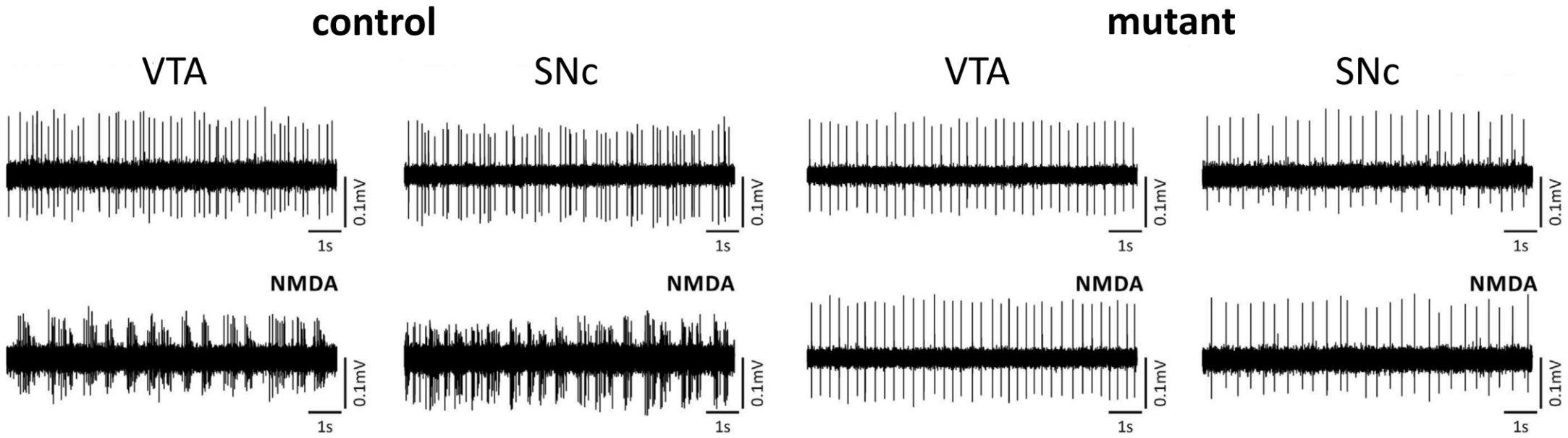


reinforcement learning (Schultz et al., 1997)
action initiation (Syed et al., 2016; da Silva et al., 2018)
incentive motivation (Flagel et al., 2011)
vigor and effort (Ko and Wanat, 2016)

Disruption of burst firing in dopamine neurons

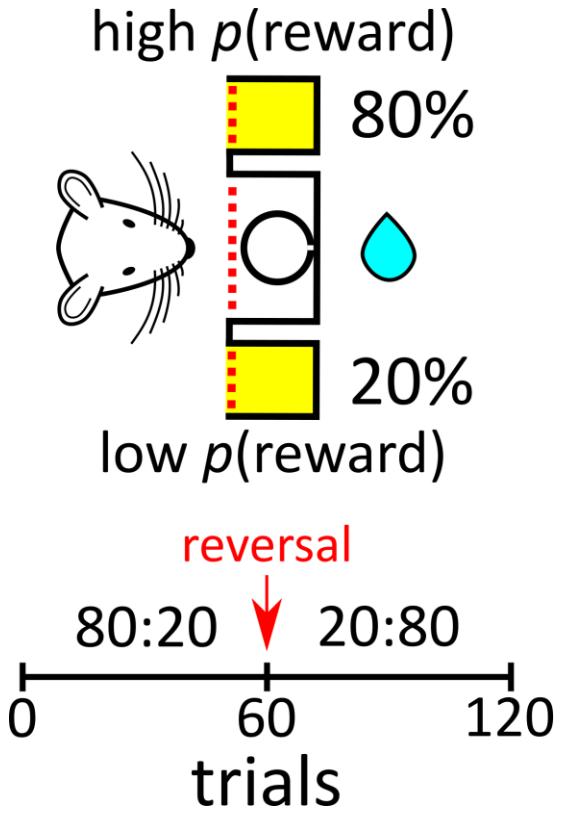


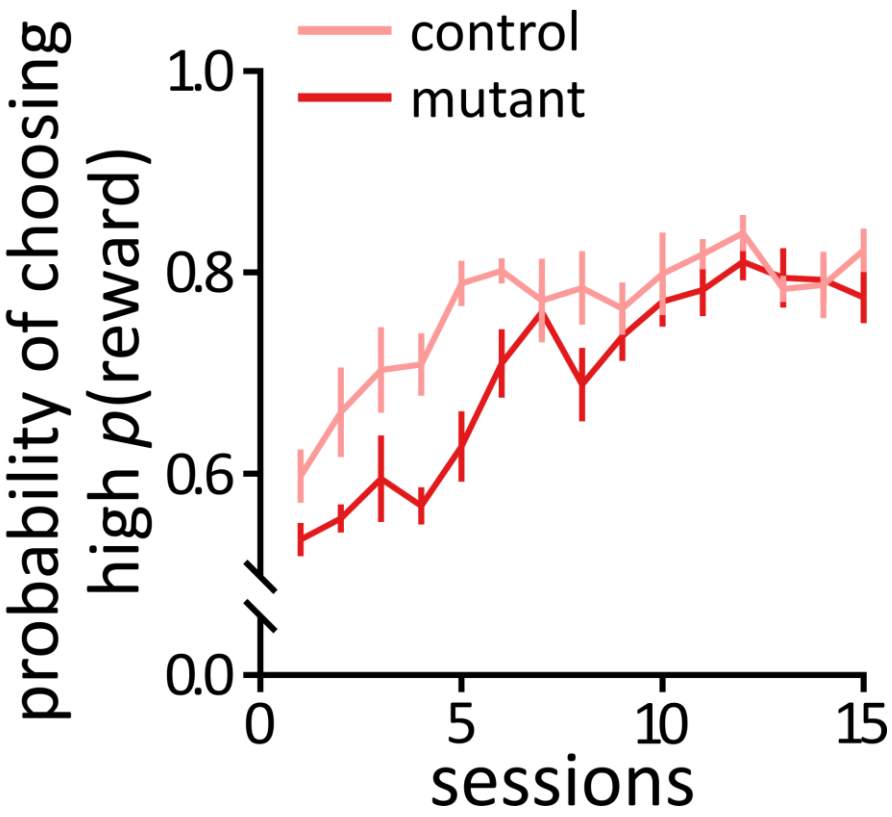
Disruption of burst firing in dopamine neurons



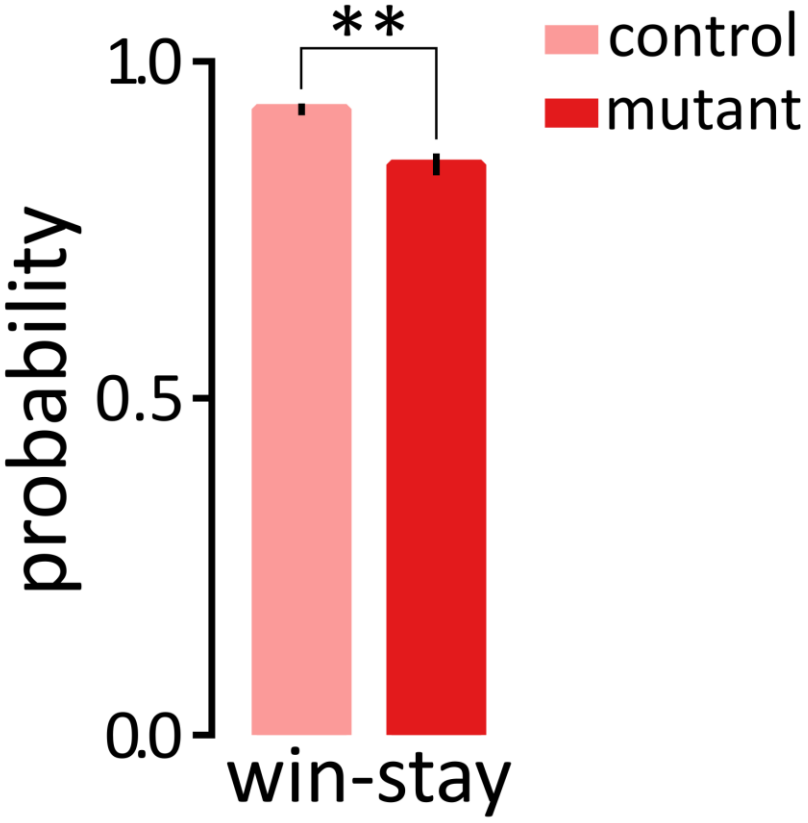
Jastrzębska et al., 2016

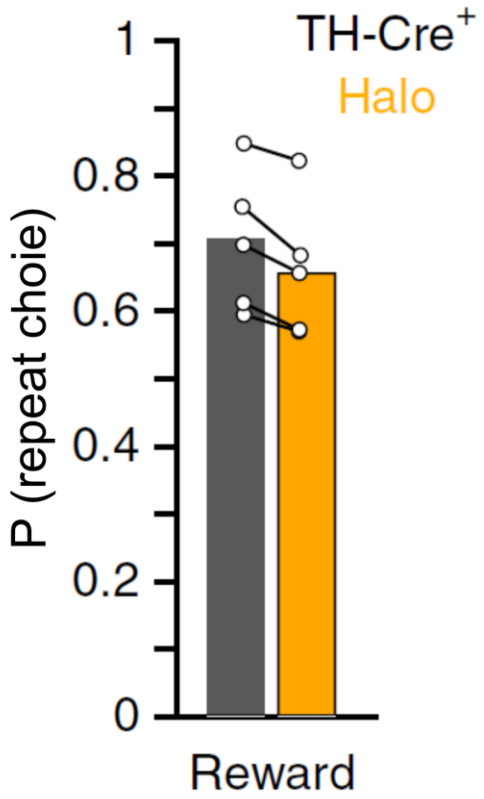
Selection of more frequently rewarded alternative





Effect of previous outcome on choice

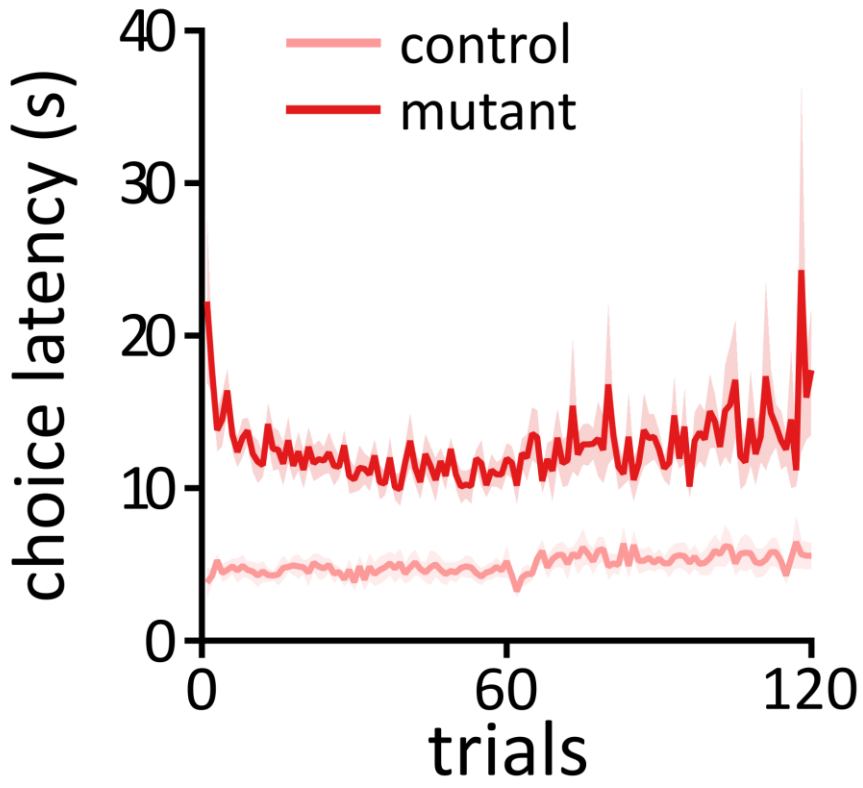




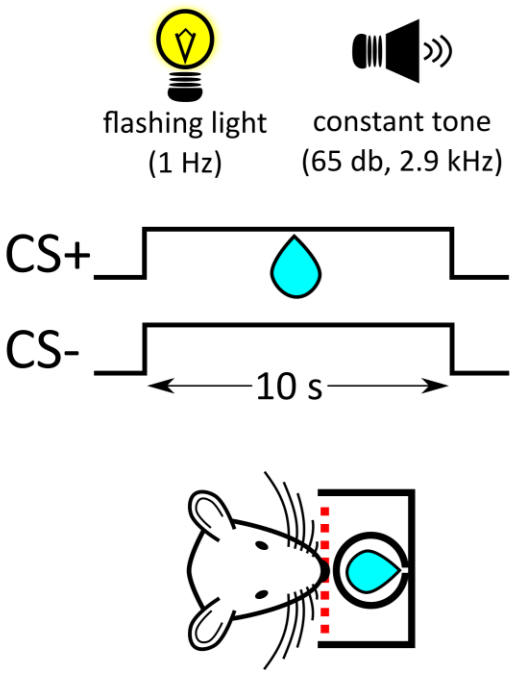
** $p < 0.01$

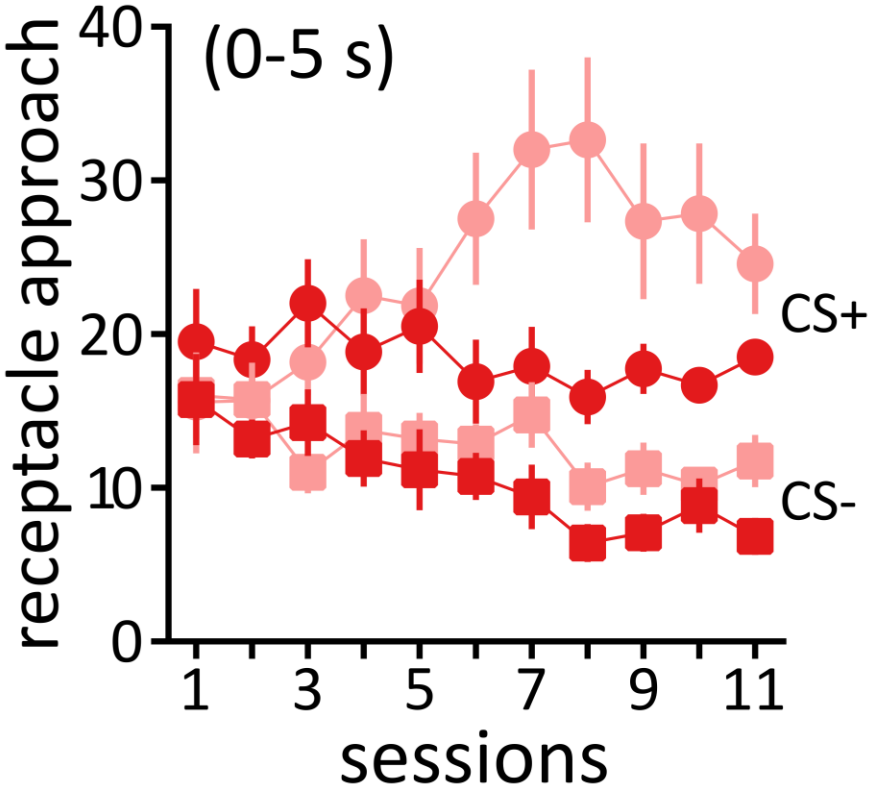
Hamid et al., 2016

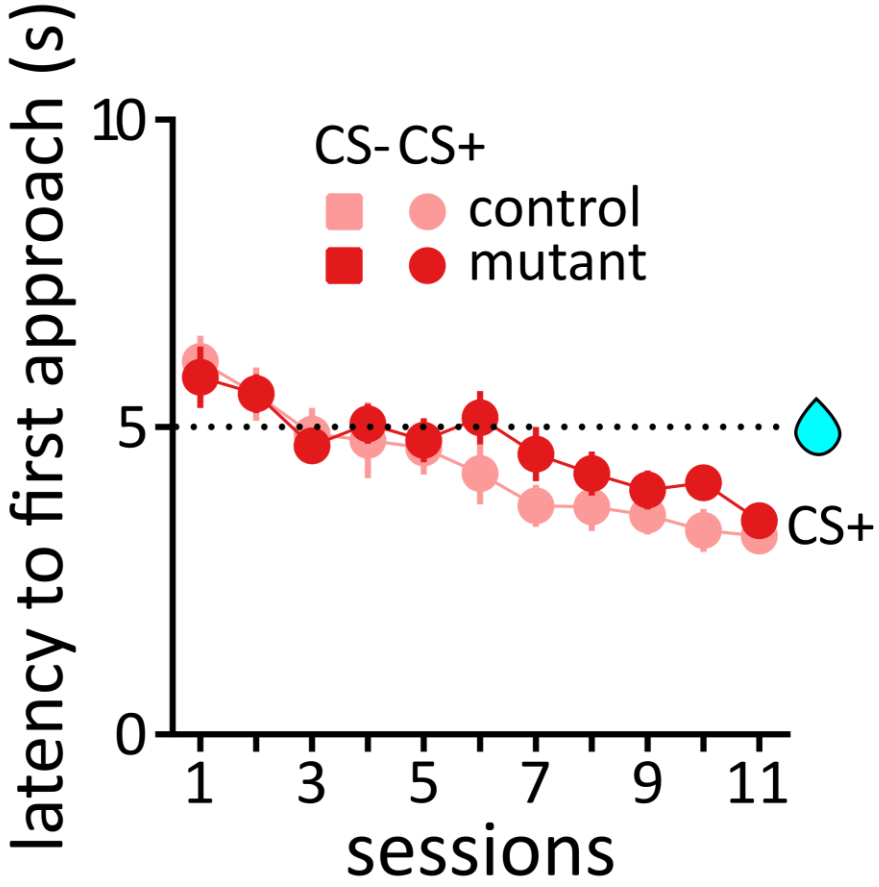
Choice latency



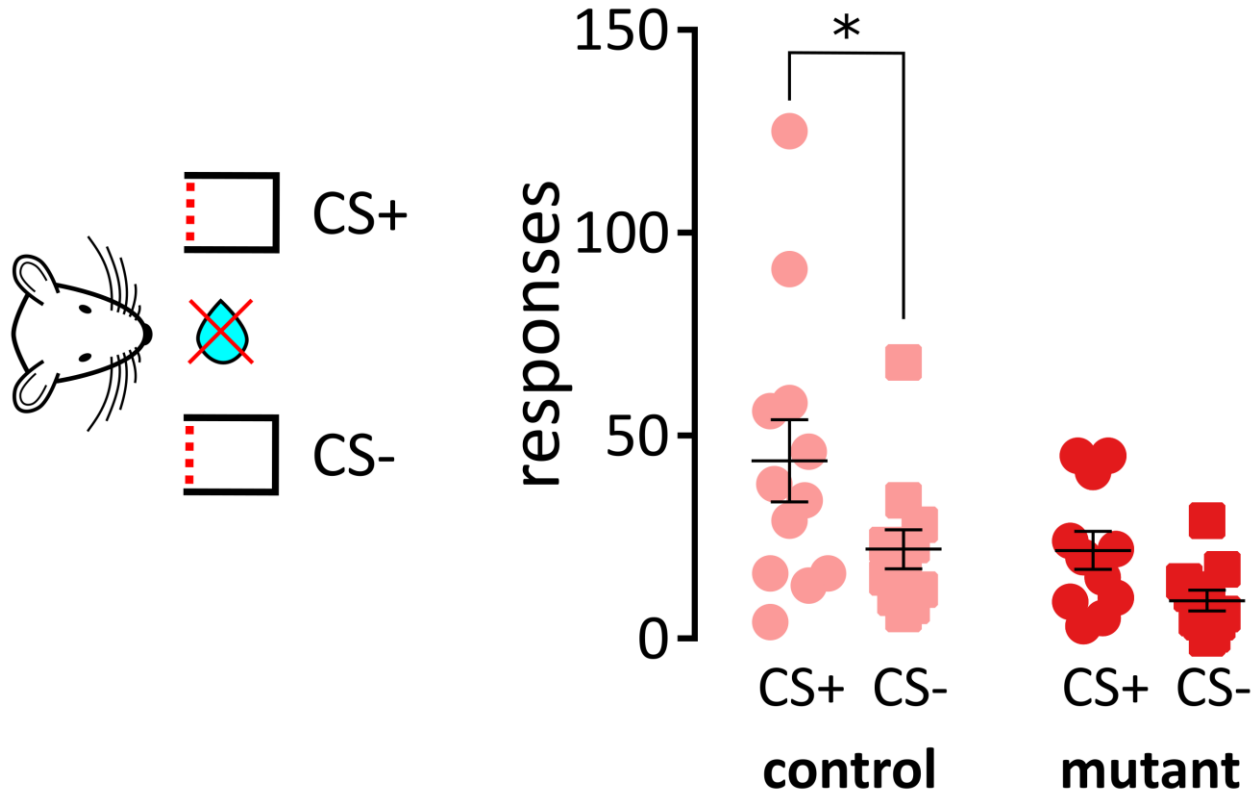
Stimulus-reward learning





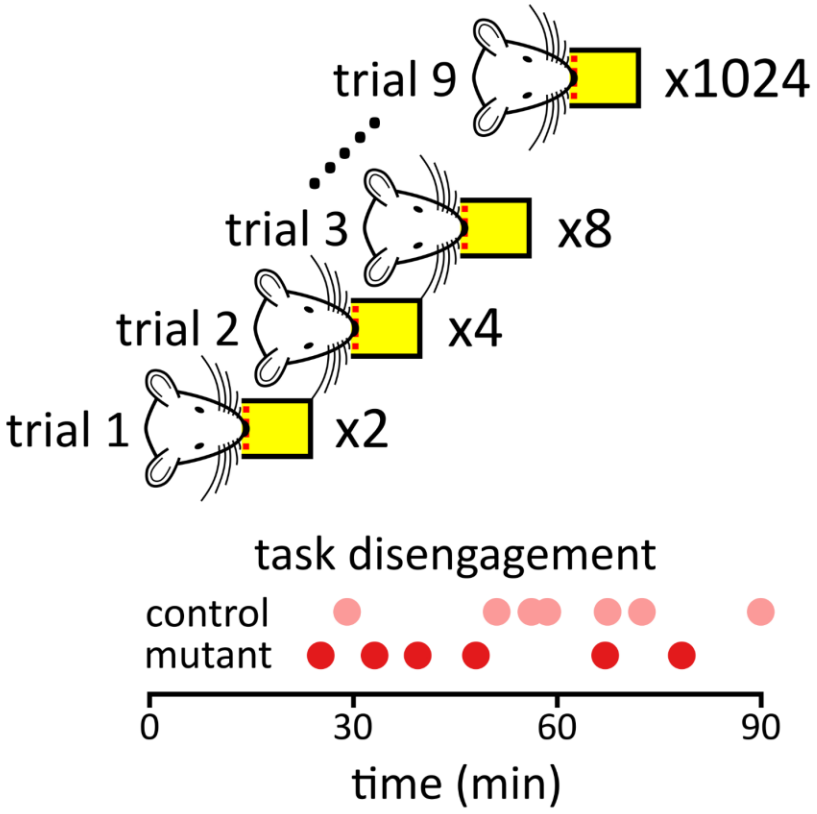


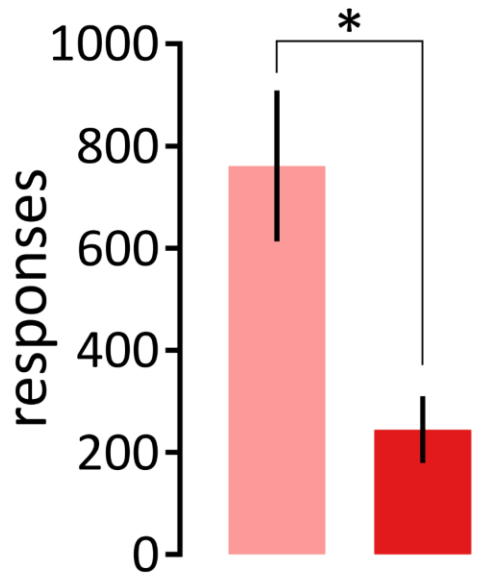
Attribution of incentive motivational value

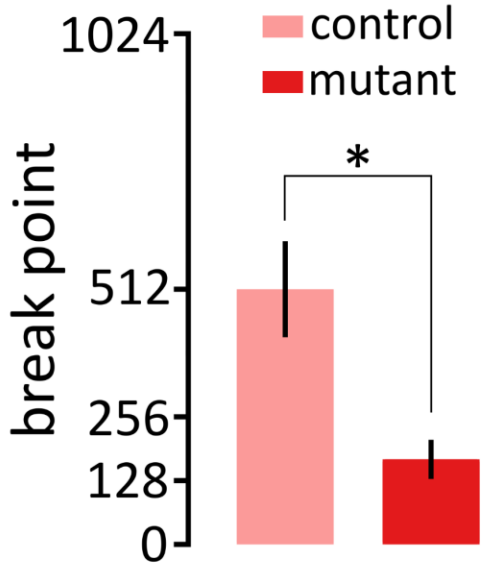


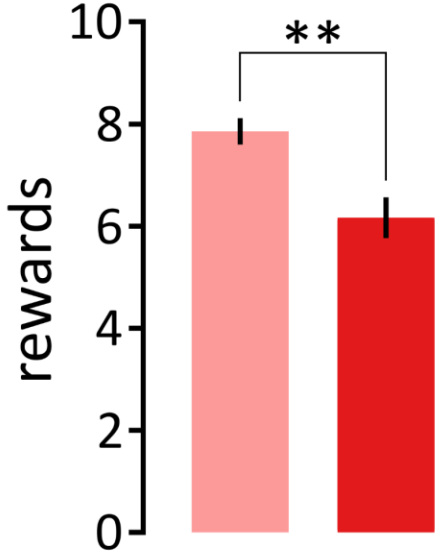
* $p < 0.05$

Motivation to engage in reward-seeking behavior



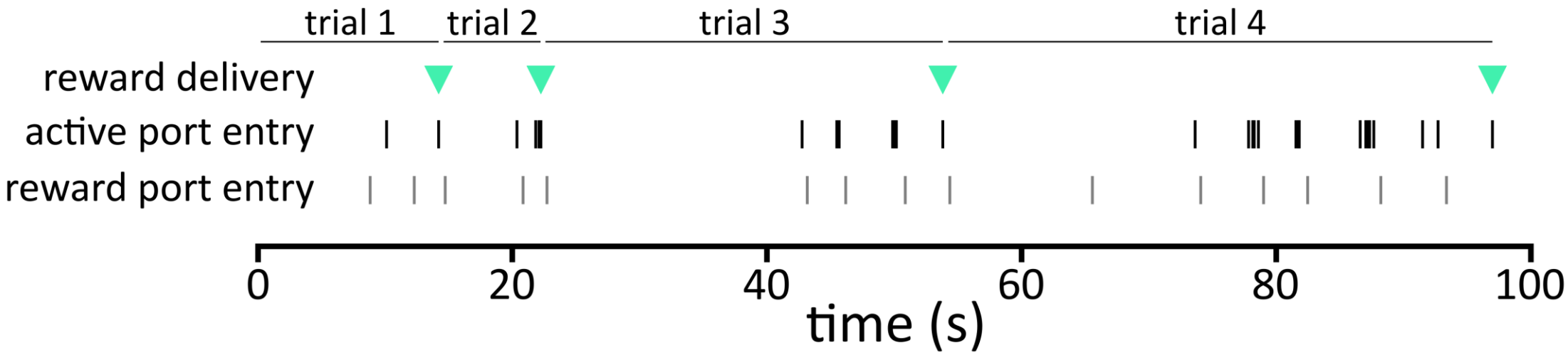




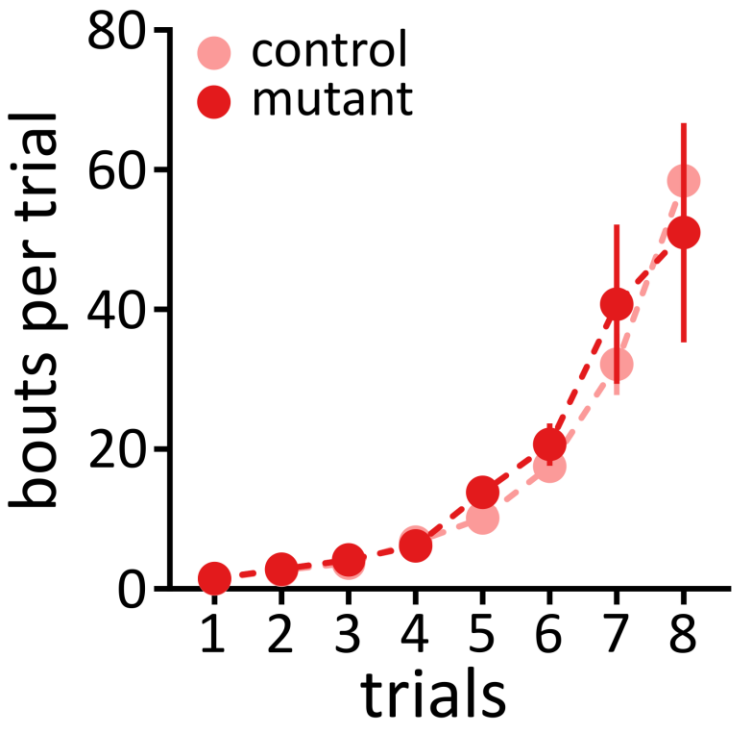


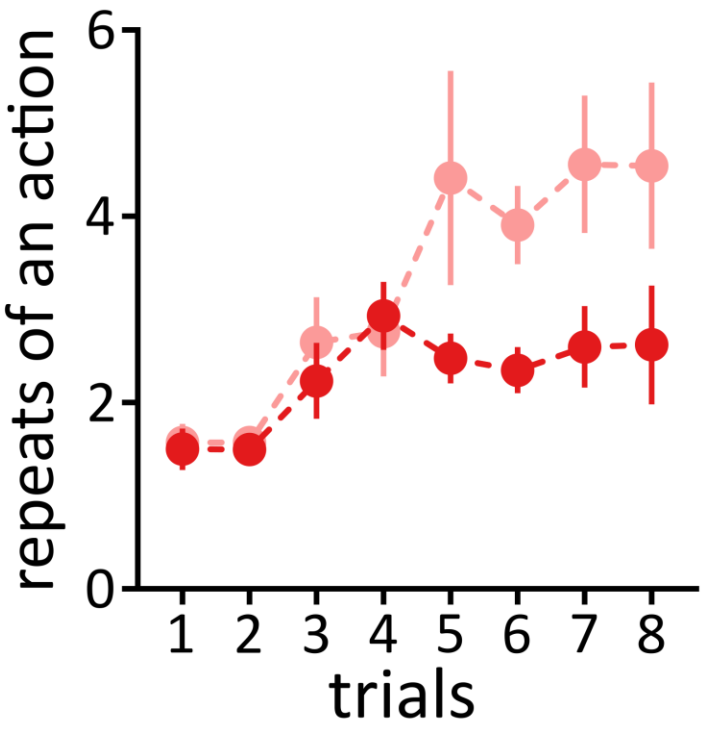
* $p < 0.05$, ** $p < 0.01$

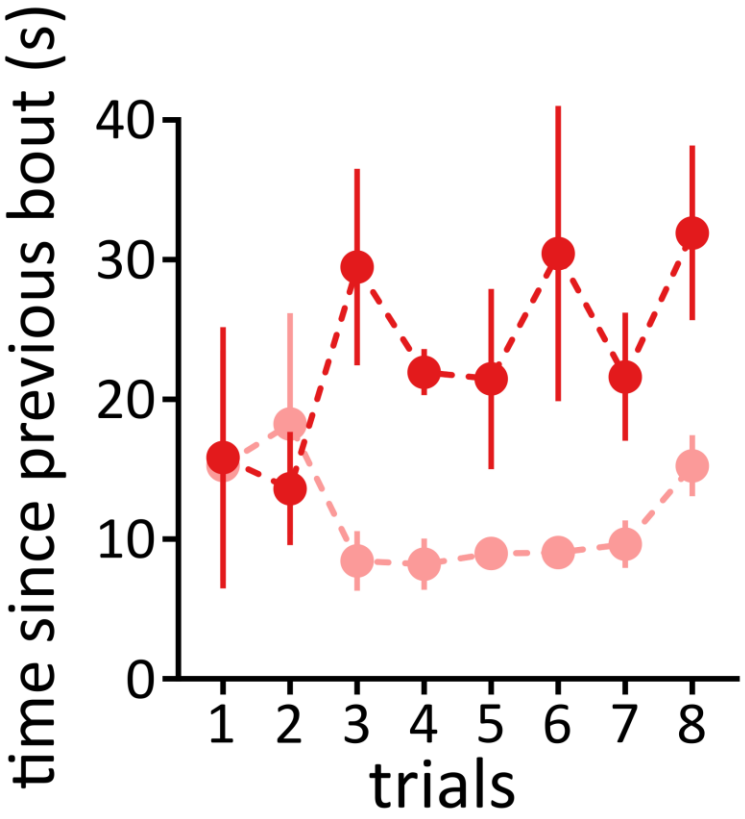
Response vigor



Response vigor







Summary

NMDA receptor-dependent burst firing in midbrain dopamine neurons play a role in reinforcement learning by affecting the likelihood of repeating of rewarded actions and the speed of decision-making

NMDA receptor-dependent signaling in midbrain dopamine neurons is crucial for attribution of incentive motivational value to reward-paired stimuli and regulation of motivated behavior, by controlling response vigor and the amount of effort exerted

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Thank You!