Cortical-hippocampal circuits mediate prosocial behaviors

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Social behaviors and decision-making processes encompass all interactions within the social domain that are influenced by or directed toward others. Among these, social learning, such as the ability to acquire behaviors by observing conspecifics, represents a fundamental mechanism for the transmission of adaptive behaviors. Like humans, mice learn from their conspecifics to associate stimuli and cues that predict threats or rewards for self and others, representing a fundamental aspect of inter-individual relationship across mammals. Furthermore, using a social decision-making paradigm, we previously revealed that the dorsal CA1 region (dCA1) of the hippocampus is a critical area for learning of prosocial behaviors through observation. However, the current understanding of the brain circuits and molecular mechanisms of if and how prosocial behaviors are acquired and its integration between cortical regions and the hippocampus, remains unclear. To investigate the neural circuits involved in the observation of prosocial behaviors we first used retroviral tracing in the dCA1 using $Fos^{2A\text{-}iCreER}$ mice that allow permanent labeling of activated neurons. We revealed activation of dCA1 direct inputs from cortical regions, primarily the prelimbic (PL) and retrosplenial (RSC) cortices. Therefore, we implemented the analysis of the PL→dCA1 and RSC→dCA1 neural activities using fiber photometry recordings during observation of prosocial behaviors. We revealed different patterns of neural activity during observation and social decision-making of prosocial behaviors observed or performed by mice. Furthermore, silencing PL→dCA1 projections, while did not affect social learning, resulted in a shift toward selfish choices, reinforcing the importance of prefrontal-hippocampal communication in social decision-making. Finally, to build upon this circuit identification we will explore synaptic plasticity changes within these regions that could enable the encoding of socially-transmitted information. In conclusion, this study advances our understanding of the neural basis of social decision-making that may contribute to improve insights into disorders characterized by social and cognitive impairments.