Dopamine: A Social Neurotransmitter

Vraj Patel

Introduction

Humans live in a social world. We constantly exercise the social aspect of the mind in our everyday lives, face-to-face with others, in large group settings, and even online. Social interactions are critical to human life; without them, we may not even be considered "human."

Social interactions involve many parts of the brain, both in performing them and their outcomes. Dopamine plays an interesting role in the outcomes of social interactions. It is a neurotransmitter involved in pleasure, satisfaction, motivation, and body movements (Costa & Schoenbaum. 2022). Dopamine mainly functions in a brain pathway involved in motivation: the mesocorticolimbic pathway. Originating in the ventral tegmental area (VTA), dopaminergic neurons – neurons that release dopamine – project to the nucleus accumbens (NAc) and the prefrontal cortex (PFC). This pathway allows for producing and maintaining feelings of motivation and desire (Reynolds & Flores, 2021). Such feelings may arise during social situations, impacting our interactions and promoting the necessity of sociality in humans (Krach et al., 2010). The focus of the discussion is on the connection between social environments and dopamine pathways.

The Reward System and Dopamine

Research conducted by Dr. Solié Clément, Dr. Benoit Girard, and their team at the University of Geneva explored the activity of the VTA in mice during periods of social interaction. They found that the VTA dopamine firing rate increased when the mice were in social contexts, particularly in this case, when other mice were present in their view. Additionally, the physical proximity of other mice was correlated with an increase in VTA activity. This means that the closer the other mouse was to the experimental mouse, the more activity was recorded. The team concluded that being around other mice activated the "reward" pathway in the brain, increasing the mouse's desire to remain in the social setting and driving social interaction.

The study also found that within the VTA, a subset of neurons activate only when experiencing "novel" stimuli and decrease firing when habituated to a certain stimulus. When an experimental mouse was repeatedly placed in a context with the same mouse, the VTA firing levels reduced after each subsequent round, suggesting habituation towards the social stimuli. These findings complicate the VTA and reward system of the brain.

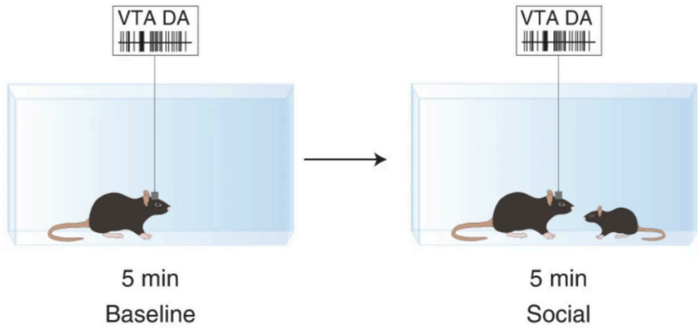

Figure 1. Important Regions Regarding Neurogenesis. In-depth view of where neural stem cells proliferate. (2023). Neural Stem Cell Culture Protocols. https://www.sigmaaldrich.com/US/en/tec hnical-documents/protocol/cell-culture-an d-cell-culture-analysis/stem-cell-culture/n eural-stem-cell-culture-protocols

Future Research with Dopamine and Social Contexts

Dopamine activity occurs during social situations, as seen in the mice in Solié's study. This brain feature may be a reason for the necessity of social environments for certain species, including humans. The involvement is complex, though, as repeated exposure to the same individual lessens dopamine activity, demonstrating habituation. Future research could explore decreased dopamine levels, as seen in some neurological disorders, and their effect on social interactions. Such research could provide information on whether dopamine levels are a factor causing social interactions, or whether they are an output of being social.

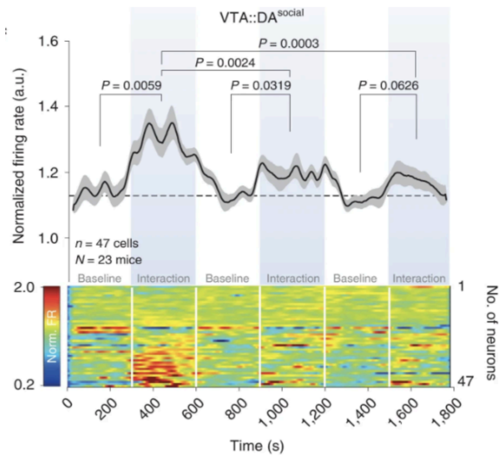

Figure 2. The activity of VTA DA neurons when the mouse was in social settings. The black line demonstrates the firing rate during the baseline and when interacting. During each subsequent interaction, the VTA firing rate decreases, as seen by the diminishing firing peaks (Solié et al. 2021).

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