NEUROSCIENCE

Distinct neural activation in a shared brain network for social and asocial behavior

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Living in society means that individuals encounter more complex environments, which demand more complex cognitive skills to cope with the increased variability in the environment. Many species live in social groups, which offers the possibility to learn from the behavior of others, contrary to learning from non-social cues. However, which agents in the brain are responsible for social and asocial learning and if the mechanisms behind them are distinct, are still unidentified. A study published in *Communication Biology* shows that in zebrafish, there are shared brain circuits behind these two processes, but with distinct localized neuron activation for the two learning types.

The researchers from the Gulbenkian Science Institute used social and asocial cues in classic conditioning in zebrafish while measuring *c-fos* expression to reconstruct the network of the areas activated in the brain for each learning type. Here, there were no differences in performance between the two types of learning, although zebrafish have a known preference for social cues. Then, neural network analysis showed higher activity in the olfactory bulbs, ventral habenular nuclei, ventral telencephalic region, and ventromedial thalamic nuclei with social learning retrieval compared to the non-social cue group. The anterior tubercular nucleus and dorsal habenular nuclei, on the other hand, showed reduced activity during the retrieval of asocial learning. These results showed that some of the structures of the functional networks were shared between the two types of learning, especially in the ventral and rostral medial regions, suggesting a common learning module; however, a specific model responsible for social integration seems to be in place.

This study suggests that different tasks and social contexts need different strategies for information integration, despite the robust modularity of the brain networks across all groups. The study also found that the social learning treatment displayed significantly higher integration across neuron communities than the asocial one. The results provide insights into the neural mechanisms underlying social learning and the processing of social information in animals and may have implications for understanding the evolution of social behavior. Additionally, a better understanding of the neural basis of social learning and cognition can help develop better interventions to improve social deficits in individuals with disorders such as autism spectrum disorder.

Jorge Ferreira

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