NEUROSCIENCE

Watch and learn: role of hypothalamic neurons in mirroring aggression

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Social species, such as mice and humans need to adjust and behave in accordance with the actions of others, whether or not these actions are directed at them. Accumulating evidence indicates that mirror cells – specialized brain cells that are active both when an individual performs an action and observes others performing it – contribute to these complex behaviors and increase adaptability to the surrounding environment. A new study published in *Cell* demonstrates that mirror neurons in the ventromedial hypothalamus (VMH) are active both when male mice fight or witness aggressive behavior.

Using a combination of behavioral, genetic, and optical techniques, the researchers from Stanford University found that a population of VMHvl^{PR} neurons exhibited "mirroring" properties, showing activation both when mice engaged in aggressive behavior or witnessed it. Using a mirror-TRAP strategy to express target transgenes forcing the activation and inhibition of a subset of VMHvl^{PR} neurons which are activated when witnessing attacks (observer VMHvl^{PR} neurons), Yang et al. showed that while activation resulted in greater aggression in the mouse, aggression decreased upon inhibition. Non-territorial social behaviors were not affected by this strategy.

The team also studied the role of sensory cues and previous social experience for neuronal activation and the regulation of aggression. *Trpc2*$^{-/-}$ male mice incapable of sensing pheromones showed activation of VMHvl^{PR} neurons when observing aggression, but no activation was seen when the mice were in the dark, showing the important role of visual cues of aggression, regardless of chemosensory cues. Additionally, males naive to mating and territory disputes responded with similar aggressive behavior than males with previous social experience, demonstrating an innate nature of this behavior.

These findings suggest that the VMH, which has been considered an "attack center" for the past few decades, serves a more complex purpose, such as perceiving aggression that is not just directed at oneself. Aggression mirroring neurons might have an important evolutionary and social role given that aggressive interactions are stressful and taxing. Aggression-mirroring can serve an important social role, in which confrontation is avoided by indirectly inferring one's social standing through observational cues. Overall, this study offers intriguing new information on how individual neurons can influence higher cognitive functions responsible for social behavior.

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