

## Genetic and circuit analysis of empathy behaviors in the mouse

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Unraveling neural mechanisms underlying social behaviors is one of the major subjects in neuroscience. Diverse tools recently developed for doing experiments in rodents allow multidisciplinary studies on this subject at levels spanning from molecules to systems. Empathy, the capacity to recognize and share emotions with others, is crucial for our social interaction and mental well-being. This ability is conserved from rodents to humans, and the anterior cingulate cortex (ACC) is known to be integral in the acquisition of observational fear (OF), a model of empathic fear. Despite the fundamental importance of genetic factors underlying individual variability in empathy-related behaviors, molecular and cellular mechanisms in the ACC that control observational fear remain to be determined. Through examining several mutant strains for OF behaviors as well as through behavior-driven forward genetic analyses, we found several gene mutations that influence OF behavior in the mouse. One of them, a missense mutation in *Nrxn3*, causes an increase in observational fear. Using a combination of tools we find evidence that *Nrxn3* is an essential molecule for inhibitory synaptic transmission in somatostatin (SST)-positive neurons. Further studies uncovered a novel role of SST interneurons in the ACC, i.e., gating the expression of socially incited fear. These results show what the rodent system can offer to unravelling neurobiological mechanisms of empathy.