The Neurobiology of Social Bonding and Empathy-Related Behavior: Implications for Autism

Socially monogamous prairie voles provide an opportunity to examine neurobiological and genetic mechanisms underlying complex social behaviors, including social bonding and empathy-related behaviors. Oxytocin receptor (OXTR) signaling in the nucleus accumbens (NAcc) is critical for pair bond formation between mates. Our data suggest that oxytocin links the neural encoding of the social signature of the partner with the rewarding aspects of mating through interactions with dopamine. Genetic polymorphisms robustly predict natural variation in OXTR expression in the NAcc, which predict pair bonding behavior. Oxytocin also plays a developmental role, organizing the circuits involved in pair bond formation. Neonatal social isolation disrupts pair bonding in some adult prairie voles. Voles with high densities of OXTR in the NAcc are resilient to neonatal neglect. We have also explored prairie vole empathy-like behavior, specifically consoling. Prairie voles increase partner-directed grooming toward mates that have experienced an unobserved stressor. This consoling response is abolished blocking oxytocin receptor antagonist into the anterior cingulate cortex, a region involved in human empathy. Finally, loss of a bonded partner leads to development of depressive-like “grieving” behavior mediated by corticotropin releasing factor (CRF), which suppresses oxytocin secretion. Infusion of oxytocin into the NAcc prevents social loss-induced depression. There are remarkable parallels between these studies in voles and recent studies on human relationships, suggesting that the neurobiology of social attachment is conserved from rodent to man. In humans, intranasal oxytocin enhances eye gaze into the eyes of others, the ability to infer the emotions of others from facial cues, empathy, and socially reinforced learning. Thus the oxytocin system may be a viable target for drugs to improve social functioning in autism.

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