Dopaminergic neurotransmission in the NAc mediates social play behavior in rats

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Social play behavior is the most characteristic social behavior displayed by young mammals, and it is one of the principal indicators of healthy development, both in animals and humans. For instance, deficits in social play behavior have been reported in several neurodevelopmental psychiatric diseases such as autism and attention deficit-hyperactivity disorder (ADHD). In this view, dissecting the neural circuits underlying social behavior at young age could provide a deeper understanding of the neurobiology of this behavior both in health and diseases states.
Social play is highly rewarding and it is modulated through neurotransmitters involved in reward processes such as dopamine, endogenous opioids and endocannabinoids. Our recent studies have shown that opioid neurotransmission in the nucleus accumbens (NAc) and endocannabinoids in NAc and amygdala mediate social play reward in adolescent rats. Although stimulation of mesolimbic dopaminergic neurotransmission plays a critical role in the incentive motivational properties of drugs of abuse and natural rewards, the role of dopaminergic neurotransmission in the modulation of social play behavior remains unclear. Therefore, the present study had a twofold aim: 1. to investigate the role of NAc dopamine in social play behavior in adolescent rats; 2. to determine whether NAc dopaminergic neurotransmission underlies the play-enhancing effects of cannabinoid and opioid drugs. To this aim, we equipped four-week-old Wistar rats with bilateral cannulae aimed specifically at the NAc and we tested the effects of intra-NAc infusion of amphetamine and the dopamine receptor antagonist alpha-flupenthixol. Intra-NAc infusion of low doses of amphetamine enhanced social play behavior and these effects were antagonized by intra-NAc co-infusion of a non-effective dose of alpha-flupenthixol suggesting that NAc dopamine neurotransmission modulates social reward. Intra-NAc infusion of alpha-flupenthixol also antagonized the play-enhancing effects of systemic treatment with the anandamide hydrolysis inhibitor URB597: thus, URB597 increased social play in rats that received intra-NAc vehicle but not in animals that received intra-NAc alpha-flupenthixol. Furthermore, alpha-flupenthixol attenuated the increase in social play induced by systemic administration of the opioid receptor agonist morphine.
These findings suggest that NAc dopaminergic neurotransmission exerts an important role in social play and closely interacts with endocannabinoid and opioid systems in the modulation of this behavior.