Neuroscience Current Issue Behaviour Experiment

Neurodegeneration and Sensorimotor Deficits in the Mouse Model of Traumatic Brain Injury

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Traumatic brain injury (TBI) can result in persistent sensorimotor and cognitive deficits, which occur through a cascade of deleterious pathophysiological events over time. In this study, we investigated the hypothesis that neurodegeneration caused by TBI leads to impairments in sensorimotor function. TBI induces the activation of the caspase-3 enzyme, which triggers cell apoptosis in an in vivo model of fluid percussion injury (FPI). We analyzed caspase-3 mediated apoptosis by terminal deoxynucleotidyl transferase dUTP nick end labeling (TUNEL) staining and poly (ADP-ribose) polymerase (PARP) and annexin V western blotting. We correlated the neurodegeneration with sensorimotor deficits by conducting the animal behavioral tests including grid walk, balance beam, the inverted screen test, and the climb test. Our study demonstrated that the excess cell death or neurodegeneration correlated with the neuronal dysfunction and sensorimotor impairments associated with TBI.

Periaqueductal gray/dorsal raphe dopamine neurons contribute to sex differences in pain-related behaviors

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Sex differences in pain severity, response, and pathological susceptibility are widely reported, but the neural mechanisms that contribute to these outcomes remain poorly understood. Here we show that dopamine (DA) neurons in the ventrolateral periaqueductal gray/dorsal raphe (vlPAG/DR) differentially regulate pain-related behaviors in male and female mice through projections to the bed nucleus of the stria terminalis (BNST). We find that activation of vlPAG/DRDA+ neurons or vlPAG/DRDA+ terminals in the BNST reduces nociceptive sensitivity during naive and inflammatory pain states in male mice, whereas activation of this pathway in female mice leads to increased locomotion in the presence of salient stimuli. We additionally use slice physiology and genetic editing approaches to demonstrate that vlPAG/DRDA+ projections to the BNST drive sex-specific responses to pain through DA signaling, providing evidence of a novel ascending circuit for pain relief in males and contextual locomotor response in females.