

Neural mechanism of social and emotional behavior – from pecking order to ketamine

Emotions color our lives and profoundly shape the way we think and behave. Research in my lab aims to understand how emotional and social behaviors are encoded in the brain, with a main focus on the neural circuitry underlying depression and social dominance. I will talk about these two lines of research in this seminar.

Neural Circuit Mechanism of Social Hierarchy

Dominance hierarchy has a great impact on societal function and individuals' life quality. The social economic status has been identified as the single strongest predictor of health. Getting to the top of the social hierarchy is not simply determined by brute strength, but by personality traits such as grit, and social experience such as history of winning or losing. We discovered that the social hierarchical status of the animal correlates with the synaptic strength in the medial prefrontal cortex (mPFC) neurons. mPFC-based neural circuitry also underlies the winner effect, where animals increase their chance of victory after repeated winning. I will present our latest progress on mapping the neural circuitry involved in the control of dominance behavior.

Rapid antidepressant mechanism of ketamine

The discovery of the rapid antidepressant effects of the NMDA receptor antagonist ketamine is arguably the most significant advance in the field of psychiatry in the last half century. But the mechanism of how ketamine elevates mood so quickly has remained elusive. The rapid “hit-and-go” temporal profile of ketamine suggests that ketamine is likely to act on a system that is tonically in action and has NMDAR channels open. In this talk, I will present data to show how ketamine regulates mood and depression by blocking the burst firing of brain's anti-reward center, the lateral habenula (LHb). I will also discuss a perisomatic K⁺ buffering mechanism by which a glial potassium channel regulates LHb neuronal bursting in depression.