Laboratory for Advanced Brain Functions

Institute for Protein Research

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Our laboratory studies neural circuit mechanisms underlying various advanced brain functions, such as cognitive learning and decision-making behaviors, using molecular techniques for controlling neural circuit activity and visualizing neural activity in specific neural circuits. We use several mouse models to reveal molecular pathologies of neuropsychiatric diseases. In particular, we focus on molecular mechanisms of gene-environment interactions in the pathogenesis of mental disorders. We also promote translational research for targeting mental disorders in collaboration with clinical departments and pharmaceutical companies.

Analysis of Neural Circuit Mechanisms of Higher Brain Functions

We have developed methods to control specific neurotransmissions in the basal ganglia in mice, and have shown that specific neural circuits play unique roles in cognitive learning behavior. We are now using the mouse cognitive taskto elucidate the regulatory mechanisms of neural circuits in advanced brain functions (Figure 1). We are also analyzing the neural circuit mechanisms of instinctive and social behaviors. We also use optogenetic and pharmacogenetic methods to control neural circuits. We visualize the activity of specific neurons in mice under behavioral conditions and observe them using miniature microscopy and fiber photometry (Figure 2).

Analysis of molecular pathogenesis of neuropsychiatric disorders

The molecular pathogenesis of many neuropsychiatric disorders remains unclear, delaying the development of fundamental treatments. We are investigating the molecular pathogenesis of psychiatric diseases by analyzing behavioral, pathological, and molecular abnormalities observed in mouse models of psychiatric disorders that have been transgenic with genetic mutations found in patients with psychiatric disorders. By further analyzing factors such as the social environment, we are investigating the mechanism of pathogenesis from the viewpoint of the interaction between genetics and environment.

Translational Research for Mental Illness

We have been conducting translational research on psychiatric disorders in collaboration with clinical departments and pharmaceutical companies. We will continue to conduct research aimed at drug discovery.

Figure 1. Cognitive learning task for mice

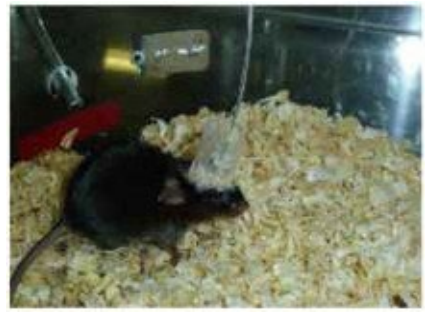

Figure 2. Fiber photometry to observe specific neuronal activity in a mouse during behavior.

Let's study together to reveal mechanisms in our brain!

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