**Scientific abstract**

Memory storage is a fundamental brain process essential for daily functioning, and its disruption is linked to various neurological disorders. Identifying the molecules involved in memory formation remains a complex challenge. EphrinB2 is a promising protein thought to be crucial in memory formation due to its involvement in several cellular processes that may be involved in this function. For instance, ephrinB2 is known to regulate glutamate transmission through AMPA and NMDA receptors and to influence dendritic spine development. However, its specific roles in memory formation are not fully understood. This study aims to investigate the roles of ephrinB2 signaling in the formation of fear memory. Toward that end, we will employ behavioral, molecular and cellular techniques, and advanced imaging approaches. Preliminary data indicate that deleting ephrinB2 in excitatory neurons or astrocytes within the basolateral amygdala (BLA) impairs long-term but not short-term fear conditioning memory. On the other hand, introducing ephrinB2 into the BLA has been found to enhance long-term memory formation for fear conditioning. In this project, we plan to further elucidate the molecular and cellular mechanisms by which ephrinB2 mediates long-term memory formation in the BLA. Specifically, we will: 1) Investigate how ephrinB2 regulates glutamate transmission during memory formation by controlling AMPA receptor trafficking, stabilizing synapses, modulating NMDA receptors in excitatory neurons, and regulating glutamate reuptake through astrocytic transporters; 2) Explore how ephrinB2 influences gene expression changes in neurons and astrocytes following fear conditioning; 3) Assess the impact of ephrinB2 on the morphogenesis of neuronal spines following fear conditioning, both when acting directly in neurons and indirectly through astrocytes; and 4) Evaluate the effects of ephrinB2 in neurons and astrocytes on neuronal and astrocytic activity in the BLA during fear conditioning, as well as during short-term and long-term memory retrieval. This research will provide critical insights into how ephrinB2 functions in neurons and astrocytes to support memory formation and clarify its role in neuron-astrocyte interactions during memory processes. Additionally, it will offer valuable information on potential therapeutic strategies for fear-related and memory-related disorders through targeted modulation of ephrinB2 activity.