ABSTRACT
THE VENTRAL HIPPOCAMPUS DYNAMICALLY REGULATES AMYGDALA ENCODING AND LEARNED FEAR

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The nervous system has evolved a set of survival circuits optimized to respond to environmental threats. Adaptive threat responding requires learning to predict when and where a threat may occur based on available cues. Such learning depends on a distributed network of brain structures, but there is much we do not understand about how these brain areas interact to support fear memory. Addressing this gap is crucial for understanding anxiety- and fear-related disorders as dysfunction in fear learning networks is implicated in the development and persistence of pathological fear states. In my dissertation work, I used a rodent model of episodic fear learning to determine how two key nodes of the fear network, the ventral hippocampus and the amygdala, contribute to the formation of a fear memory. The role of the ventral hippocampus, in particular, during associative fear memory is unclear. Unlike the more studied dorsal hippocampus, the ventral hippocampus is implicated in emotional regulation and may serve as an emotional-cognitive interface in memory. Here I characterize how the ventral hippocampus and basolateral amygdala encode emotionally salient events during associative fear conditioning, test the necessity of aversive encoding in the ventral hippocampus to memory formation, and determine whether direct communication between the ventral hippocampus and amygdala is needed for fear learning and amygdala encoding. The results highlight two adaptive functions of the ventral hippocampus in fear learning: 1) hippocampal encoding of aversive events affects how the fear memory is subsequently expressed, and 2) hippocampal communication with the amygdala is needed for fear learning with temporal or contextual cues. These results may provide targets for future therapeutic interventions considering the ventral hippocampus is implicated in several mood-disorders characterized by exaggerated, inappropriate expression of fear.