

Sensory processing and fear overgeneralization in stress-induced anxiety, across the visual system

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Project outline:

Anxiety disorders stem from dysfunctions in the circuits that process aversive stimuli. When confronted with potential dangers, animals must select the appropriate behavioural response. In an environment full of complex stimuli, threat cues can sometimes be ambiguous, making it challenging to distinguish between dangerous and irrelevant stimuli. The ability to generalize across similar stimuli is an adaptive strategy that protects animals from fatally missing a potentially deadly environmental cue. In other words, “better safe than sorry”. However, an exaggerated generalization of fear to harmless stimuli (i.e. “fear overgeneralization”) is maladaptive and considered a hallmark of numerous anxiety disorders¹. The cellular and circuit mechanisms mediating fear overgeneralization are largely unknown. This PhD project investigates the development of fear overgeneralization at the level of the sensory circuits that process aversive information. Using the mouse visual system as a model, we will focus on a visual cortex selectively activated by innately fearful stimuli, targeted by the amygdala, and driven by a midbrain center that triggers avoidance behaviors. We will determine how changes in the neural sensory representations of dangerous and safe visual stimuli affect the animals’ ability to discriminate them. Given the critical role of preexisting stress in the pathogenesis of numerous anxiety disorders, we will test the hypothesis that emotional distress changes how sensory stimuli are encoded during learning, leading to fear overgeneralization. Through chronic 2photon imaging, large-scale electrophysiology, and innovative behavioral tasks, we will determine the effects of severe stressors on early sensory processing, during the development of stress-induced anxiety.