Active avoidance depends on inhibitory responses in rostral prelimbic neurons.

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Much is known about the neural circuits of conditioned fear and its relevance to understanding anxiety disorders, but less is known about other anxiety-related behaviors such as active avoidance. Using a tone-signaled, platform-mediated active avoidance task, we observed that pharmacological inactivation of the prelimbic prefrontal cortex (PL) delayed the expression of avoidance. However, optogenetic silencing of PL neurons did not delay avoidance. Consistent with this finding, inhibitory, but not excitatory, responses of rostral PL neurons to the tone were present in avoidance-trained but not fear-conditioned or naïve rats. To oppose inhibitory responses, we photoactivated rostral PL neurons during the tone to maintain pre-tone firing rate. Photoactivation of rostral PL (but not caudal PL) neurons at 4 Hz (but not 2 Hz) delayed or prevented avoidance. These findings suggest that inhibitory neuronal responses in rostral PL signal the option to avoid danger, and underscores the importance of designing behavioral optogenetic studies based on neuronal firing patterns. Ongoing studies are examining whether projections of rPL to the ventral striatum or baslolateral amygdala are necessary for active avoidance using optogenetic techniques.

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