

Fear and other anxiety linked emotions are evolutionary conserved across the species that aid survival by increasing awareness and enable rapid responses to possible hazards. Excessive fear and anxiety, on the other hand, are hallmarks of a variety of disabling anxiety disorders like PTSD (Post Traumatic Stress Disorder) or phobias that affect millions of people throughout the world. Understanding the neural circuits underlying processing of fear memory, its extinction and how they drive behaviour open the new perspectives to form novel groups of drugs supporting treatment of those emotional disorders.

In our lab, a fear inhibition is studied through a procedure in which a previously fear conditioned organism is exposed to a fear-eliciting cue in the absence of any aversive event. This procedure results in a decline in conditioned fear responses that is attributed to a process called fear extinction. In this paradigm, we study time-dependent changes in circuits involved memory processing by manipulating neuronal activity in regions of higher activity during extinction learning.

In this model of study, we have discovered that medial septal nucleus (MS) and nucleus reuniens (RE) have elevated activity during fear memory extinction processing. Moreover, inactivation of RE neurons strongly enhance attenuation of fear that was acquired 24 hours before (recent) and robustly prevents the extinction of distant (remote/30 days-old) one. Downregulating of MS nucleus also results in impairment of remote fear extinction memory processing.

Abovementioned observations and anatomical connections of RE and MS lead me to hypothesize, that particularly RE-MS circuit is necessary for an animal to extinguish fear memory and function of this connection is changing with time. Taken together my planned experiments will have a great impact of understanding neurobiological mechanisms underlying time-dependent extinction of fear, especially that research community nowadays pays more attention to how time affects processing the traumatic experiences.