

Synaptic correlates of associative fear memory in the lateral amygdala. Choi et al., (2021) Neuron. Sept. 109(17):2717-2726. [Article](#)

Re-interpretation based on the IPL mechanism

Experiments have shown that activated ensembles of synapses have significantly larger spine morphology in the auditory cortex-to-lateral amygdala synaptic region after auditory fear conditioning. Fear extinction reversed these ensembles of enlarged spines, whereas re-conditioning with the same tone and shock restored the spine size of the synapses (Choi et al., 2021). In fear conditioning experiments, foot shock is a high energy stimulus, and it is likely to generate several inter-postsynaptic functional LINKs (IPLs) in the amygdala in a time-dependent manner. This can explain why fear conditioning is observed after three hours following foot shock (Rumpel, 2005). Furthermore, it was observed that memory is reduced after three hours of blocking of synaptic incorporation of AMPA receptors in as few as 10 to 20% of lateral amygdala neurons (Rumpel, 2005). This needs a timescale-matched explanation. Based on the semblance hypothesis, spine enlargement takes place at the time of associative learning. Enlarged spines can promote IPL formation that takes place in milliseconds. Intra-spine GluR1 vesicle fusion to the lateral spine head membrane that incorporates membrane segments to the lateral spine head region and enables IPLs to advance to more stabilizable states. If this is blocked, then it will lead to reversal of formed IPLs at specific locations of convergence of signals from associatively learned stimuli. It also matches with the delay in the induction of LTP after stimulation (Vadakkan, 2019). Another inference is that internal sensation of memory results from net semblance induced at a minimum number of inter-LINKed spines.

References

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