



## "Structural substrates of excitatory and inhibitory long-term memory."

### Speaker

**PhD Linnaea Ostroff**

*Connecticut Institute for the Brain  
and Cognitive Sciences  
Institute of Materials Science  
University of Connecticut*



### Time

**Thursday, 20<sup>th</sup> October 2022**  
5:00 PM

### Location

**via zoom**

<https://gwdg.zoom.us/j/85147921523?pwd=RHpuSGFaUXlnMWVZOWFIVjUwTVAxQT09>

Meeting ID: 851 4792 1523

Passcode: 696145

### Abstract

Memory formation is generally understood to require persistent, protein synthesis-dependent changes in synapse structure and function, but most evidence for structural changes comes from observations of excitatory synapses during formation of new memories. Relatively less is known about the long-term memory phase and whether manipulation of existing memories changes synapse structure. In addition, little is known about structural changes in inhibitory synapses or whether excitatory and inhibitory memories differ. To compare synapse structure across phases and forms of memory, we combined electron microscopy (EM) volume reconstructions with Pavlovian fear conditioning, a simple but robust learning paradigm in which an associative memory is formed between an auditory cue and a noxious stimulus. Fear conditioning is mediated by enhanced synapse strength in the lateral amygdala (LA), and we found enlargement of excitatory LA synapses associated with upregulated dendritic polyribosomes during the transient protein synthesis-dependent phase of memory formation. This is consistent with the hypothesis that local protein synthesis supports rapid synaptic remodeling after learning. Unexpectedly, we found that upregulated polyribosomes persisted into the protein synthesis-independent long-term memory phase, and neither memory retrieval nor extinction of the memory by many unreinforced cue presentations resulted in further upregulation of dendritic polyribosomes. These data suggest that dendritic polyribosomes reflect the history and state of synapses more than active translation processes. Although extinction learning inhibits the original fear memory, it resulted in selective pruning of very small synapses, consistent with preservation and potential reinforcement of the initial memory trace as opposed to weakening or erasure. Inhibitory learning can also be produced by safety conditioning, in which the cue is initially associated with safety instead of danger. Safety learning, but not extinction, resulted in an increased number of inhibitory synapses onto excitatory dendrites. Overall, these experiments demonstrate that structural changes at synapses reflect specific types and states of memory.