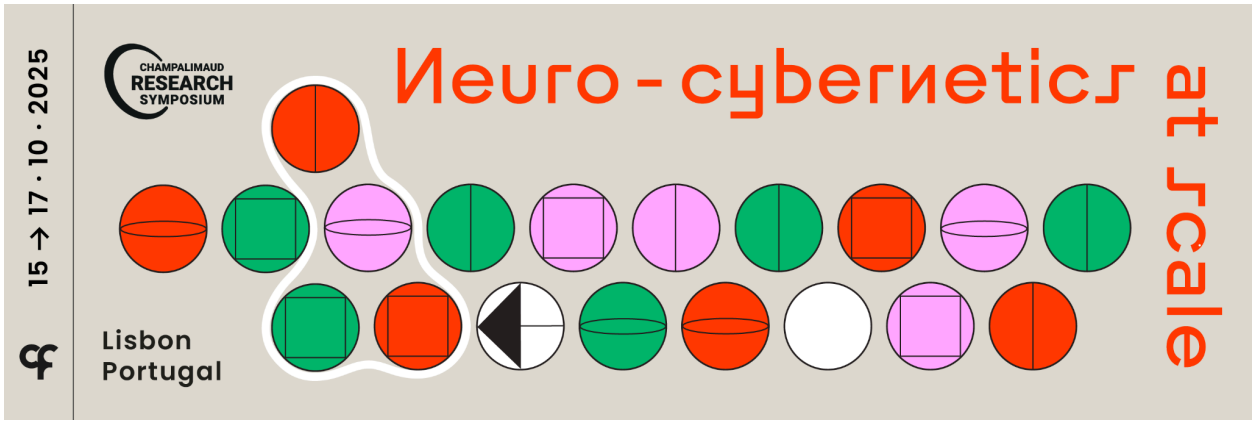

Brief Critical Windows for Memory Consolidation are Regulated by Behavioral State

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Long-term memories are consolidated over time, progressively becoming more stable and resistant to interference. Memory consolidation occurs offline and often involves transfer of memories from one brain site to another. For many motor memories, consolidation is thought to involve early learning in the cerebellar cortex that is subsequently transferred to the cerebellar nuclei. Here we report that in mice, engaging in locomotor activity during training in a classical conditioning task shifts the critical time window for memory consolidation, from just after training sessions, to between trials, within sessions. This temporal shift requires natural patterns of cerebellar granule cell activity during intertrial intervals and is accompanied by earlier involvement of the downstream cerebellar nucleus. These results reveal that the critical time window for cerebellar memory consolidation can be surprisingly brief, on a timescale from seconds to minutes, and that it is dynamically regulated by behavioral state. In ongoing experiments we are imaging granule cell activity to investigate how their activity patterns change during different memory consolidation windows and behavioral states.

associative learning, memory consolidation, behavioral state, locomotor activity