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Neural circuits underlying motor skill learning and execution

Abstract: I will introduce a new motor skill learning paradigm that trains stereotyped complex motor sequences in rodents. Targeted lesions show that motor cortex is essential for learning these skills, but not for executing them, thus dissociating motor cortex's role in motor learning and control. Neural recordings from motor cortex-recipient striatum (dorsolateral striatum, DLS) revealed that DLS neurons encode the learned skills in a sparse, reliable, and premotor manner, indicative of a causal role in skill execution. Consistent with this, lesions to DLS interfered both with motor skill learning and execution, while selective ablation of motor cortical inputs to the striatum abolished learning. Taken together, these results suggest that motor cortex guides plasticity in striatum during skill learning, allowing subcortical motor circuits to acquire and autonomously execute motor skills.