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**Title**: Neuroplasticity in the CNS as a function of motor skill learning: A systematic review and meta-analysis.

**Abstract**:

**Objectives**: In order to quantitatively evaluate neuroplastic changes, we conducted a systematic review of the literature and meta-analysis of neuroimaging studies (fMRI & PET).

**Data Collection**: English language articles in PsycINFO (EBSCO), Google Scholar, and PubMed (as of August 2012); bibliographies of retrieved papers.  Longitudinal studies with at least one learning contrast using healthy populations were included. 38 studies and 72 contrasts were included in the meta-analysis.

**Data extraction**: Contrasts were recoded to fit two meta-contrasts: Early > Late, representing decreases in activity over time; Late > Early, representing increases in activity over time. Studies were coded for timescale of learning: short (S, < 2 hrs), moderate (M, < 1 d), and long (L, < 8 wk). Peak coordinates were extracted from studies to be analyzed using Activation Likelihood Estimation.

**Results**: In S, decreases were found in the inter-parietal lobule, premotor cortex, and cerebellar cortex; no significant increases were found (FDR < .001). In M, decreases were found in associative and prefrontal areas of the cortex and the cerebellar cortex; increases were found in primary and supplementary motor cortex, the putamen, and the dentate nuclei of the cerebellum (FDR < .001). In L, decreases were found in premotor areas of the frontal cortex and the insula; increases were found in the putamen (FPR < .001).

**Conclusion**: Meta-analytic results suggest two neurological "loops" involved in learning: a cortico-thalamo- cerebellar loop involved in adaptation and a cortico-thalamo-gangliar loop involved in learning the value of actions at different levels of representation.