

Arc expression and neuroplasticity in primary auditory cortex during initial learning are inversely related to neural activity

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Models of learning--dependent sensory cortex plasticity require local activity and reinforcement. An alternative proposes that neural activity involved in anticipation of a sensory stimulus, or the preparatory set, can direct plasticity, so that changes could occur in regions of sensory cortex lacking activity. To test the necessity of target--induced activity for initial sensory learning, we trained rats to detect a Low Frequency sound. After learning, *Arc* expression and physiologically--measured neuroplasticity were strong in a High Frequency auditory cortex region that lacked target--induced activity in control animals. After 14 sessions, *Arc* and neuroplasticity were aligned with target--induced activity. The temporal and topographic correspondence between *Arc* and neuroplasticity suggests *Arc* may be intrinsic to the neuroplasticity underlying perceptual learning. Furthermore, not all neuroplasticity could be explained by activity--dependent models, but can be explained if the neural activity involved in the preparatory set directs plasticity.