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Presentation Abstract

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Title:	Sound-driven modulation of sub- and suprathreshold activity in mouse primary visual cortex
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Abstract:	Integration of multimodal information is essential for the integrative response of the brain and is thought to be accomplished mostly in sensory association areas. However, available evidences in humans and monkeys indicate that this process begins already in primary sensory cortices. However, how cross-modal synaptic integration occurs in vivo along cortical microcircuitries remains to be investigated. Primary sensory cortices of rodents are well-suited to address this issue as they have a well-known anatomy and synaptic physiology. Here we quantified how acoustic stimulation (white noise, 50 ms duration) affects spontaneous and sensory-driven activity of pyramidal neurons in different layers of primary visual cortex by intrinsic signal imaging-targeted in vivo whole-cell recordings in lightly anesthetized and awake, head-fixed mice. Acoustic stimuli reliably evoked hyperpolarizations -lasting about 200-300 ms- in layer 2-3 and 6 neurons, but not in the main thalamorecipient lamina, layer 4. We found depolarizing responses to sound only in layer 5 (about 1/4 of recorded neurons), whereas the remaining cells exhibited no response or hyperpolarizations. To explore the synaptic nature of sound-driven hyperpolarizations in supragranular pyramids, we measured the inhibitory and excitatory conductances elicited by sound. Hyperpolarizations were due to the combined effect of activation of inhibitory conductances along with a withdrawal of excitatory ones. In agreement with this, sound-driven hyperpolarizations were

significantly reduced by intracellular perfusion with a cesium-based solution containing 1 mM picrotoxin to block GABA-B and GABA-A receptors, respectively (-3,3 ± 0,4 mV vs -1,1 ± 0,3 mV, t-test, p<0,001).
We next quantified the impact of sound-driven inhibition on visual responsiveness by coupling flashed or moving light bars with white noise. Sub- and suprathreshold responses were significantly reduced in the case of bimodal stimulation compared to the pure visual modality (of about 30 and 50%, respectively, paired statistics, p<0.05).
Finally, transection experiments guided by intrinsic signal imaging indicated that auditory-driven synaptic inputs onto visual cortical neurons persisted despite inactivation of horizontal connections between primary visual and auditory cortices.
Taken together, our findings illustrate a simple scheme by which spontaneous and evoked activity in a retinotopic column of the mouse primary visual cortex can be shaped by the acoustic external environment in a layer-specific manner.

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