

## Representation of stimulus-, task-, and choice-related information in rodent auditory cortex revealed by chronic current-source density recordings

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The fundamental role of the primary auditory cortex (A1) in auditory learning and memory is well-documented. However, primary sensory cortex has been considered classically to process, extract and represent mainly sensory stimulus features, while the learning- and choice-related meaning of a stimulus might be more associated with higher-order brain areas. In this study, we therefore chronically recorded current source density (CSD) distributions from A1 of Mongolian gerbils (*Meriones unguiculatus*), while animals performed multiple reversals of the choice-outcome contingency in a Go/NoGo shuttle-box frequency discrimination task to investigate cortical circuit mechanisms underlying flexible auditory guided behaviors and decision making. We could demonstrate that not only sensory, but also task- and choice-related information is represented in the neuronal population code distributed across cortical layers. A detailed behavioral analysis based on performance levels and receiver operator curve (ROC) characteristics revealed different behavioral strategies and allowed us to correlate them with distinct cortical activation patterns. We found distinct differences of spatiotemporal columnar circuit activity between classes of choice and contingency in a layer-specific manner. Strongest recruitment of particularly infragranular layers corresponded to trials in which animals showed a conditioned response independent of the contingency, while supragranular activity was highest during correct hit trials. During correct rejections we generally found the lowest columnar activity suggesting an active inhibition of cortical processing. We further applied multivariate statistics and classified spatiotemporal activity patterns representing stimulus- or task-related features by linear support vector machine learning. While stimulus information was most prominently represented during tone-presentation, representation of task-related information about the meaning of the stimulus exceed.