

Timing sound: A study to identify brain areas underlying timing in the range of hundreds of milliseconds

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The neural mechanisms underlying the ability to time stimulus durations in the range of hundreds of milliseconds to seconds are not known. Even the identity of the brain areas responsible has not been conclusively determined. Adapting the methods of Mainen and colleagues and Zador and colleagues, we have trained separate groups of rats in two different two-alternative forced-choice tasks. In the first task, rats must discriminate between pure tone sounds based on the duration of the sound; on each trial rats must classify a pure tone as either “long” or “short”, as compared to a fixed standard. In the second task, rats must discriminate between pure tone sounds based on the *frequency* of the sound. Both these tasks present similar stimuli and require the same behavior to indicate discrimination of stimuli. Thus we have two audition-based decision-making tasks, only one of which requires the ability to time sound.

We are using excitotoxic chemicals (ibotenic acid) to lesion different auditory structures. If found, a lesion that affects duration discrimination, but not frequency discrimination, would identify the lesioned brain region as one required for timing-based behavior, but not required for aspects of the timing task shared with the frequency discrimination task (e.g., motivation, decision-making, motor control, etc.). Such a region would be considered critical for perceptual timing, at least in the auditory modality. If such a region is indeed found, we plan to record and analyze neural activity from it during performance of the duration discrimination task. We are targeting the auditory cortex (areas A1, AuV, AuD), the different divisions of the medial geniculate body, and the auditory striatum.

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