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Neural Coding of an Auditory Pitch Illusion

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ABSTRACT

Pitch is an important perceptual dimension in audition, supporting auditory object segregation, melody recognition and lexical distinction. Huggins' pitch, for example, is a phenomenon evoked by two sources of broadband noise presented binaurally with an inter-aural phase shift over a narrow frequency band. Huggins' pitch and other dichotic pitches have been studied extensively using perceptual experiments. Several models have been proposed to explain and predict the perception of pitch; however, no studies have tried to record *in vivo* neuron responses to Huggins' pitch (HP) nor have tried to explain how the HP is coded by neurons. The existence of pitches arising from the detection of binaural temporal cues may suggests that at least some of the "pitch neurons" involved must be linked to binaural unmasking: a phenomenon whereby binaural processing enhances the perceptual signal-to-noise ratio in noisy environments. To evaluate the neural coding of HP, in vivo recordings of chinchilla auditory nerve fibers (ANFs) and medial superior olivary (MSO) axons were made. Monoaurally and binaurally spike trains were gathered from ANFs and MSO axons respectively. Computational simulation using cross-correlation was used to predict the output of HP using ANFs as input and then it was compared to the recorded output (MSO). A decrease in the firing rate near the MSO neuron center frequency was found in the computation model and in the MSO neurons output. Therefore, by recording from single ANFs and single MSO fibers, we provide evidence for a de-correlation based neural coding of an auditory illusion: Huggins' pitch.

KEYWORDS

Neural coding, Huggins' pitch, coincidence detectors, cross-correlation analysis, binaural unmasking mechanisms