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Sensitivity of high-frequency inferior colliculus neurons to sinusoidal amplitude-modulation of low-frequency tones

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Responses of neurons in the inferior colliculus of awake rabbit were studied using sinusoidally amplitude-modulated (SAM) tones with a wide range of carrier and modulation frequencies. Neurometric thresholds for detection of modulation were estimated by applying both average rate and temporal metrics to neural responses. For neurons tuned to high frequencies, neurometric thresholds for SAM detection were substantially lower for mid- to high-level carriers at frequencies in the tail of the tuning curves than for carriers near the characteristic frequency (CF). Sensitivity to SAM for low carrier frequencies was often superior to sensitivity for near-CF carriers at low sound levels. These results suggest that psychophysical SAM detection thresholds at sound levels above approximately 60 dB SPL may be supported by "tail" responses of neurons tuned octaves above the carrier frequency. Improvement of psychophysical SAM detection thresholds with sound level is thus consistent with the contribution of a large population of responsive and sensitive "off-CF" neurons as level is increased. The fact that many auditory neurons, in both the peripheral and central nervous system, respond across several octaves at mid-to-high SPLs must be taken into account when considering "across-channel" interactions in tasks that involve both simple and complex sounds.