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Testing coherent reflection in chinchilla

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Coherent-reflection theory explains the generation of stimulus-frequency and transient-evoked otoacoustic emissions by showing how they emerge from the coherent "backscattering" of forward-traveling waves by mechanical irregularities in the cochlear partition. Recent published measurements of stimulus-frequency otoacoustic emissions (SFOAEs) and estimates of near-threshold basilar-membrane (BM) responses derived from Wiener-kernel analysis of auditory-nerve responses allow for comprehensive tests of the theory in chinchilla. Model predictions are based on: (1) an approximate analytic expression for the SFOAE signal in terms of the BM traveling wave and its complex wavenumber; (2) an inversion procedure that derives the wavenumber from BM traveling waves; and (3) estimates of BM traveling waves obtained from the Wiener-kernel data and local scaling assumptions. At frequencies above 4 kHz, predicted median SFOAE phase-gradient delays are in excellent agreement with the SFOAE measurements. At frequencies below 4 kHz, chinchilla SFOAEs show strong evidence of interference between short- and long-latency components. Approximate unmixing of these components, and association of the long-latency component with the predicted SFOAE, yields close agreement throughout the cochlea.