

Abstract Submitted
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A ratchet mechanism for low-frequency hearing in mammals TOBIAS REICHENBACH, A.J. HUDSPETH, The Rockefeller University — The sensitivity and frequency selectivity of hearing result from tuned amplification by an active process in the mechanoreceptive hair cells. The nature of the active process in the mammalian cochlea is intensely debated, for outer hair cells exhibit two forms of mechanical activity, active hair-bundle motility and membrane-based electromotility. Here we show theoretically that active hair-bundle motility and electromotility can together implement an efficient mechanism for amplification that functions like a ratchet: sound-evoked forces acting on the basilar membrane are transmitted to the hair bundles while electromotility decouples the active hair-bundle forces from the basilar membrane. Through a combination of analytical and computational techniques we demonstrate that the ratchet mechanism can naturally account for a variety of unexplained experimental observations from low-frequency hearing.

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