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The Nonlinear Effects of Electromotility in the Inner Ear

Sound is received and processed by mammals via mechanotransduction of traveling waves in the cochlea. Though numerous successful linear math models have been developed to describe cochlear mechanics, many significant nonlinearities exist in the traveling wave and have not been explained. Outer hair cell electromotility is the primary source of a majority of these nonlinearities. Resulting from sound stimulation and subsequent shifts in the cells' receptor potentials, electromotility is the process by which outer hair cells undergo conformational length changes. In this work, a model for electromotility will be derived, and its nonlinear effects on the traveling wave will be analyzed.