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A brownian energy depot model of the basilar membrane oscillation

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Response of a living basilar membrane (BM) is significantly different from that of the cadaver and is known to be essentially active. The best candidate for a generator of the active force in mammals is the outer hair cells. By employing the outer hair cells as the energy depot, we newly propose an interactive energy depot model for the basilar membrane. In this model, the nonlinear responses and the spontaneous basilar membrane oscillation are obtained. In the regime of small vibration, this model is reduced to the well-known Hopf bifurcation model. Our model suggests two-fold roles of the outer hair cells in hearing: an amplification for a weak stimulation and a protection for a strong stimulation.