Active nonlinear oscillators underlying peripheral auditory transduction

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Healthy ears not only detect sound but can emit it as well. These sounds, called otoacoustic emissions (OAEs) can occur either spontaneously and continuously or in response to acoustic stimulation. Evoked emissions are increasingly used as clinical diagnostic tools (e.g., newborn hearing screening). The biophysical mechanisms underlying their generation, however, are incompletely understood. In particular, OAEs occur in a wide variety of species, from frogs to humans, suggesting basic, shared principles. Here, we analyzed both spontaneous and evoked OAEs from a bird (barn owl) and a lizard (anole). We relate these data to those from humans and suggest that otoacoustic emissions originate from similar biomechanical principles despite gross differences in the underlying anatomy of the ear. We suggest that otoacoustic emissions originate from phase coherence amongst the auditory hair cells (the primary mechanotrasduction elements), which can be effectively modeled as a system of coupled active and nonlinear oscillators.

References:

[1] C. Bergevin et al., Proc. Nat. Acad. Sci. (2015) 112(11):3362-3367.