A COMPARATIVE STUDY OF EVOKED OTOACOUSTIC EMISSIONS IN GECKOS AND HUMANS

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Models of otoacoustic emission (OAE) generation mechanisms often attribute important features of OAEs to waves traveling along the cochlear partition. Since the lizard basilar papilla manifests no obvious analog of the mammalian traveling wave, detailed characterization of lizard OAEs offers an important opportunity to test and extend our knowledge of emission mechanisms. We report otoacoustic measurements (DPOAEs and SFOAEs) in the ears of adult leopard geckos (*Eublepharis macularius*) and humans. We compare and contrast the properties of gecko and human OAEs and discuss their implications for mechanisms of OAE generation.

1 Motivation

Current theories for otoacoustic emission (OAE) generation suggest that basilar-membrane (BM) traveling waves play a key role in the underlying mechanism(s) [1]. However, OAEs have been observed in non-mammals where traveling waves have not been measured. Do mammalian and non-mammalian OAEs therefore arise by fundamentally different mechanisms? Understanding any differences in their generation can provide powerful insight into the underlying inner ear physiology.

2 OAE Comparison

We performed a systematic comparison of SFOAEs and DPOAEs in both leopard geckos (*Eublepharus macularius*) and humans (*Homo sapiens sapiens*) using the same measurement system, stimulus paradigms, and animals/subjects. Table 1 summarizes our major findings to date.

Although the evoked OAEs from the two species have many qualitiative similarities,[1] they also manifest large quantitative differences. Our comparisons raise many questions, including:

[1]Spontaneous emissions have been reported in both humans and geckos [2].

	Human	Gecko
SFOAE	• Levels typically 0–10 dB SPL	• Levels similar to or larger than humans (0–20 dB SPL) over entire range of hearing (0.2–5 kHz)
	• Magnitude punctuated by numerous deep notches with corresponding phase jumps	• Occasional magnitude notches and phase jumps
	• Long phase-gradient delays (4–9 ms)	• Short phase-gradient delays (0.5–2 ms)
DPOAE	• Modest levels (∼0 dB SPL)	• Large levels (∼20 dB SPL)
	• Few measurable high-order DPs	• Many measurable high-order DPs
	• Significant differences in delay for $2f_1 - f_2$ (short), $2f_2 - f_1$ (long), and SFOAE (longest)	• Similar phase-gradient delays for lower- and upper-sideband DPOAEs; all are shorter than the SFOAE delay

Table 1. Comparison between human and gecko OAEs. SFOAE stimulus parameters: $\{L_\mathrm{p}, L_\mathrm{s}\} = \{40, 55\}$ dB SPL; $f_\mathrm{s} = f_\mathrm{p} + 40$ Hz. DPOAE stimulus parameters: $\{L_\mathrm{p}, L_\mathrm{s}\} = \{65, 65\}$ dB SPL; fixed f_2/f_1 ratio.

- Is cochlear nonlinearity much stronger in the gecko than in the human? And/or are human DPOAEs more highly filtered (e.g., by traveling waves) after generation?
- What accounts for the different phase-gradient delays seen in gecko vs human OAEs?

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