Otoacoustic Emissions in Humans, Birds, Lizards, and Amphibians: A Comparative Study Reveals Differences in Emission Generation Mechanisms

Christopher Bergevin, Dennis Freeman, and Christopher Shera
Harvard/MIT HST Speech and Hearing Science & Technology Program

ABSTRACT: Much of what is known about the generation of otoacoustic emissions (OAEs) derives from mammals and takes advantage of the medical knowledge and technology of hearing loss. To learn more about OAE generation through a systematic approach across species, we chose four species to examine here: humans (i.e. flat 2f1-f2), leopard frogs (i.e. flat 2f1-f2), leopard geckos (i.e. 2f1-f2 with some geckos well below 0 dB SPL), and P14-21 chickens (i.e. flat 2f1-f2). We measured human OAEs using traditional clinical techniques. Leopard frogs, leopard geckos, and chickens were measured using custom built equipment. OAEs were measured across frequencies, with some geckos well below 0 dB SPL! and chickens up to 5000 Hz. We discuss in detail what these emissions reveal about the function of the inner ear, but there is still much we need to understand about how these emissions are being generated and subsequently emitted. By further elucidating the physiological features such as basilar membrane (BM) traveling waves and hair cell somatic motility have played an important role in OAE generation.

SUMMARY: The comparative study here has revealed that many OAE properties are common across species (i.e. significant delays, nonlinear gain, and phase gradient versus frequency differences in BM tuning and somatic motility. However, some emissions properties do appear unique to certain ears (e.g. a frequency independent 2f1-f2 phase) and suggest that certain physiological features (such as traveling waves) play an important role in OAE generation.

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METHODS

The basic methods of OAE measurements were minimal. OAEs were measured using custom built equipment in our lab. OAEs were measured across frequencies, with some geckos well below 0 dB SPL! and chickens up to 5000 Hz. OAEs were measured with 4000 Hz, 2000 Hz, 1500 Hz, and 1000 Hz probe levels.

For the four species measured here, the basilar membrane (BM) traveling waves and hair cell somatic motility have played an important role in OAE generation.

OAEs were measured with 4000 Hz, 2000 Hz, 1500 Hz, and 1000 Hz probe levels.