DEPARTMENT OF
CHEMICAL & PHYSICAL SCIENCES
COLLOQUIUM SEMINAR SERIES

Wednesday, November 14, 2018
3:10pm in CC2150

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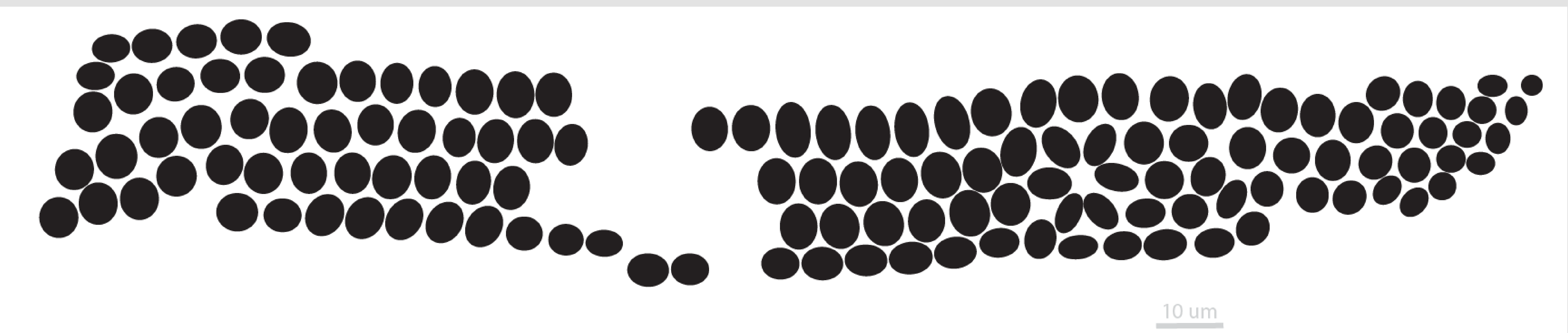
Finding the Ear's "Fingerprint"



Many aspects of biological systems are dynamically noisy (e.g., Brownian motion in cell signaling, randomized firing in networks of neurons). But there are also "static" morphological randomizations that can have functional consequences and/or biometric uses, such as the unique iris or fingerprint patterns of an individual. The ear, being an extremely sensitive detector of sound, appears to follow a similar principle: Various lines of evidence indicate that there are properties unique to individual ears that have salient perceptual consequences such as audiogram "fine structure" and biometric applications (e.g., "Nura headphones"). However, the fundamental physiological basis for such individualized "roughness" has remained elusive. To elucidate such, we describe here a study focused on reptiles. While there appears general biophysical principles universal to all "types" of ears across the animal kingdom, lizards possess relatively simpler ears (compared to the mammalian cochlea) yet exhibit all key functional characteristics (e.g., high sensitivity, sharp selectivity). Empirically, we combine "otoacoustics" (i.e., recording of low-level sounds emitted from healthy ears and detectable with a sensitive microphone placed at the ear canal) and scanning electron microscopy of the auditory papilla to examine potential correlations between function and entropic features such as random variations in hair cell arrangement. On the theoretical side, our modeling approach employs a coupled nonlinear oscillator framework and the inclusion of different stochastic aspects (e.g., noise in the coupling strength). Together, these approaches help determine if there is an observable morphological basis for roughness and thereby the foundations of our auditory "fingerprints".