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"Comparison of nocturnal vs. diurnal phototransduction amplification: Theoretical analysis of frog electroretinograms."

This study used an analytic approach to understand if amplification and temporal properties of phototransduction vary between retinas in nocturnal versus diurnal vertebrates. In vertebrate photoreceptors, phototransduction involves a cascade of biochemical steps leading to a reduction in membrane conductance, causing a decrease in membrane potential. In electroretinogram (ERG) recordings this change in potential is measured as the onset of the a-wave and can be modeled as a delayed Gaussian function. Previous theoretical analysis has shown that the function is scaled by an amplification constant (Ac) which reflects the product of the rate of phosphodiesterase activation to a single photoisomerization, the rate constant of cGMP hydrolysis by PDE, and the Hill coefficient of the cyclic GMP gated membrane channels. The rate by which the function changes is tau effective (Teff), a cumulative delay for the transduction processes. To determine Ac and Teff we used custom written software in the python virtual environment to fit the Gaussian function to the a-wave onset of ERGs in four species of frogs (2 diurnal, 2 nocturnal). A least-squares fit procedure determined the optimized values of Ac and Teff. Based on the analyses, we will test the hypothesis that the a-wave of nocturnal frogs exhibit greater amplification constants, reflecting the need for greater amplification of the reduced number of isomerizations in light-deprived environments.