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# Deterministic and Stochastic Mathematical Modeling of Melanopsin's Light Response in iPRGCs and HEK Cell

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## **DETERMINISTIC AND STOCHASTIC MATHEMATICAL MODELING OF MELANOPSIN'S LIGHT RESPONSE IN ipRGCs AND HEK CELL**

Kathleen Hoffman, Phyllis Robinson, Hye-won Kang

Melanopsin, a visual pigment expressed in intrinsically photosensitive retinal ganglion cells (ipRGCs), primarily affects non-image forming vision with a hypothesized G-protein phototransduction pathway similar to the phototransduction pathway found in *Drosophila* photoreceptors. The biochemical cascade underlying the light response in ipRGCs has not yet been fully elucidated. A deterministic and stochastic mathematical model of the hypothesized pathway is developed to probe key elements of the pathway. The rate constants, initial conditions and parameters are fit to voltage clamp data from ipRGCs and also calcium imaging data from HEK cells transfected with mouse melanopsin. Sensitivity analysis reveals key steps in the phototransduction pathway, independent of the experimental conditions, as well as key differences attributable to the different experimental conditions.

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