Optoretinographic response of human photoreceptors during dark adaptation

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***Abstract*:**

Dark adaptation is the essential process that restores visual sensitivity following exposure to bright light, yet the underlying mechanisms remain incompletely understood, and existing methods lack the resolution to probe individual photoreceptors. Here, we establish a high–spatiotemporal–resolution framework for quantifying cone dark adaptation *in vivo* using optoretinography (ORG) with adaptive optics optical coherence tomography (AO-OCT). This approach enables direct measurement of stimulus-evoked optical path length changes in single photoreceptor outer segments at milliseconds over a multi-minute recovery period following a strong photopigment bleach. We quantified cone ORG responses using four parameters. Interestingly, ORG response amplitude recovered more slowly than temporal features, revealing distinct recovery behaviors that may reflect separate contributions from photopigment regeneration and downstream phototransduction processes. These findings highlight ORG as a sensitive and fully objective method for quantifying dark adaptation process. This approach may support future studies aimed at understanding mechanisms underlying dark adaptation and probing functional deficits in diseases affecting outer-retinal health.

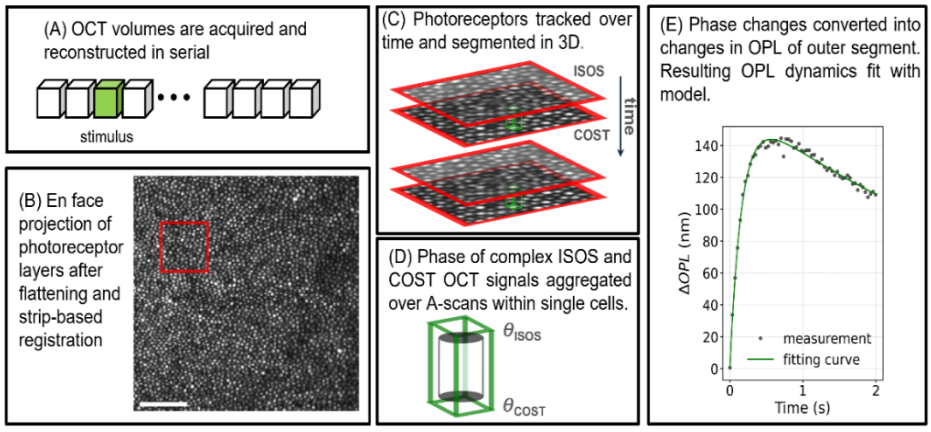

Figure 1:Key components of the ORG acquisition and processing pipeline.

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