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## Loss and gain of cone types in vertebrate ciliary photoreceptor evolution

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### Abstract

Ciliary photoreceptors are a diverse cell type family that comprises the rods and cones of the retina and other related cell types such as pineal photoreceptors. Ciliary photoreceptor evolution has been dynamic during vertebrate evolution with numerous gains and losses of opsin and phototransduction genes, and changes in their expression. For example, early mammals lost all but two cone opsins, indicating loss of cone receptor types in response to nocturnal life style. Our review focuses on the comparison of specifying transcription factors and cell type-specific transcriptome data in vertebrate retinæ to build and test hypotheses on ciliary photoreceptor evolution. Regarding cones, recent data reveal that a combination of factors specific for long-wavelength sensitive opsin (*Lws*)-cones in non-mammalian vertebrates (*Thrb* and *Rxrg*) is found across all

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