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Title: An unexpected diversity of photoreceptor classes in the Longfin squid, *Doryteuthis pealeii*

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Abstract: Cephalopods are famous for their ability to change color and pattern rapidly for signaling and camouflage. They have keen eyes and remarkable vision, made possible by photoreceptors in their retinas. External to the eyes, photoreceptors also exist in parolfactory vesicles and some light organs, where they function using a rhodopsin protein that is identical to that expressed in the retina. Furthermore, dermal chromatophore organs contain rhodopsin and other components of phototransduction (including retinochrome, a photoisomerase first found in the retina), suggesting that they are photoreceptive. In this study, we used a modified whole-mount immunohistochemical technique to explore rhodopsin and retinochrome expression in a number of tissues and organs in the longfin squid, *Doryteuthis pealeii*. We found that fin central muscles, hair cells (epithelial primary sensory neurons), arm axial ganglia, and sucker peduncle nerves all express rhodopsin and retinochrome proteins. Our findings indicate that these animals possess an unexpected diversity of extraocular photoreceptors and suggest that extraocular photoreception using visual opsins and visual phototransduction machinery is far more widespread throughout cephalopod tissues than previously recognized.

Keywords: Extraocular photoreceptors, phototransduction, light detection, opsin, retinochrome, parolfactory vesicles

Data File Description: Data are arranged into 12 Zip files, one for each figure (Figures 1-6) and one for each supporting figure (S1-6). Each Zip file includes the original images used for figures and supporting figures. Scale bars in all figures and supporting figures are 25µm.

*.tif = Images in tif format