

BLIND LIKE A SEA-CUCUMBER? Opsin-based extraocular photoreception in holothurians (Holothuroidea, Echinodermata)

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Abstract :

Vision is a primordial sense in animal evolution, and it has been mainly studied in species that developed complex eyes such as chordates and arthropods. Except for the sea star eyespots, echinoderms do not have complex visual organs but can detect light by extraocular photoreception. In eumetazoan lineages, light detection is mediated by a group of transmembrane proteins named opsins. Eight types of these opsins have been detected in the Echinoderms and many studies have found their accurate localization in the tissues of sea urchins, brittle stars and starfishes. By contrast, the photoreception of sea cucumbers (Holothuroidea) remains largely unknown. Therefore, we have investigate this photoreception in the holothurian group with three different approaches. (i) We detected, by comparison with the eight reference opsin sequences of the sea urchin (*Strongylocentrotus purpuratus*) model, at least six opsin classes in the genome of *Apostichopus japonicus* (the most complete sea cucumber genome, up to now) : one ciliary opsin (Aj-opsin1), two Go-opsins (Aj-opsin3), two melanopsins (Aj-opsin4), one peropsin (Aj opsin6), one RGR-opsin (Aj-opsin7) and one neuropsin (Aj-opsin8). (ii) We have detected by immunohistochemistry and immunofluorescence one rhabdomeric opsin-4 in the podia and oral tentacles of the Holothuriida species *Holothuria forskali*. We have also found the expression of one ciliary opsin-1 in particular anatomical structures of two holothurian species belonging to the Apodida (serpentiform sea cucumber without podia). On one hand, ocelli structures in *Euapta godeffroyi*, on the other hand, sensory cupules in *Oostergrenia digitata*. These results point to a photoreception role played by these organs. (iii) We have demonstrated that *H. forskali* and *E. godeffroyi* can react to various light stimuli. These species showed a significant negative phototropism when exposed to short wavelengths (blue and green light) which are those which propagate most efficiently and deeply in the marine environment

Oral presentation