Visual perception in the aquatic fungus *Blastocladiella emersonii*

Avelar, G. M.[1], Schumacher, R. I.[1], Zaini, P. A.[1], Leonard, G.[2], Richards, T. A.[2], Gomes, S. L.[1]

[1]Departamento de Bioquímica, Instituto de Química, Universidade de São Paulo, São Paulo, Brazil.

[2] Biosciences, University of Exeter, Geoffrey Pope Building, Stocker Road, Exeter EX4 4QD, United Kingdom

Introduction. Sensing light is an important function that allows organisms to sense and respond to their environment. Both animals and microbes use the photoreceptor rhodopsin to sense light. Phototaxis is the property of organisms to move toward or away in response to a light source. Rhodopsin acts as a photoreceptor related to phototaxis in green algae and in the flagellated swimming zoospores of the fungus *Allomyces reticulates*. However, the signaling pathway related to phototaxis in this fungus remains unknown. **Objectives** The objetive of this work is to examine the signaling pathway involved in light perception in zoospores of the fungus *Blastocladiella emersonii*. **Material and Methods** For this, we used a combination of functional inhibition studies, whole genome sequencing, protein localization and phototaxis experiments. **Results and Discussion** The present work describes a new guanylyl cyclase (GC) enzyme, named BeGC1, whose catalytic domain is fused to a bacterio-rhodopsin sensory domain. Phototaxis experiments demonstrated that zoospores are more responsive to green light than blue or red light. Photobleaching of rhodopsin function with hydroxylamine prevents phototaxis and increases in cGMP levels in zoospores in response to green light. Western blot and immunofluorescence microscopy indicates that BeGC1 protein in localized in the zoospore “eyespot”, a structure that functions as a photoreceptive organelle. **Conclusions** Altogether our data indicate that *Blastocladiella emersonii* has a cGMP signaling system involved in phototaxis, with a unique rhodopsin-GC fusion protein localized to a specialized photoreceptor organelle.

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