In the eye of the holopelagic annelid *Tomopteris helgolandica*

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Light is the basis of many photo-dependant mechanisms in organisms; perceive light is therefore essential to numerous species depending on it. In this way, light has been one of the foundations to evolution: the organisms have developed, among others, a specific organ – the eye. The opsins are the main molecules involved in the mechanism of light perception, also present in extraocular structures. It is then interesting to study such proteins in order to better understand the light detection process. Based on molecular phylogeny, opsins can be classified in four families: ciliary opsins, rhabdomeric opsins, cnidopsins and the group four opsins. The expression of these proteins is one of the most conserved characteristics of photoreceptor cells (PRCs), involved in light sensitivity - one PRC usualy express only one opsin. These proteins are thus used to identify PRC present in an organism.

Annelids possess many sensory organs, which the photoreceptor-like sense organs taking part in the annelid vision are the best-investigated. Therefore, one can take advantage of annelids to gain insights in the knowledge of light detection process.

Transcriptome data analysis in *Tomopteris helgolandica*, a bioluminescent and holopelagic polychaete, reveal that at least nine different opsins are expressed. These molecules are differently distributed between the cephalic and the body regions, questioning the respective role of the organs expressing them. The results of the project showed different expression patterns for four cephalic opsins, which can be related to each other and lead to the assumption of opsin co-expression. They also showed unexpected sensory structures into the brain tissue for which the nature remains unknown. Moreover, we observed similarities between annelid species, in the structure and the formation of the eyes.

In conclusion, the results obtained during this project are added to previous researches and provide new information about *Tomopteris helgolandica* and more specifically about its visual system. In addition to provide new insights into the understanding of visual systems and photoreceptor cells, they open new red lines into the bioluminescence process and to the possibility of its relation with light perception in numerous bioluminescent species.

Keywords: *Tomopteris helgolandica*; visual system; opsin; photoreceptor cells; bioluminescence