

Molecular evolution of vision in Ecdysozoa

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Project description: At the molecular level vision is mediated by proteins belonging to the Opsin family. Opsin evolution is relatively well understood in both Vertebrata (humans, fishes, and their relatives) and in Arthropoda (insects, spiders and their relatives). Further to that, the early history of opsins evolution has recently been clarified¹. The phylum Arthropoda belong to a major invertebrate division called Ecdysozoa, which also includes the Nematoda (round worms) and a variety of other less known phyla: Priapulida (the penis worms), Kinorhyncha (mud dragons), Nematomorpha (the Gordian worms), Tardigrada (water bears), Onychophora (velvet worms) and the poorly known Loricifera². Ecdysozoa includes two of the most successful animal phyla (Arthropoda – the most biodiverse animal phylum) and Nematoda (representing the largest majority of animal biomass). Arthropoda represents the only known invertebrate group in which colour vision evolved through a several gene duplications (with different opsin genes absorbing light of different wave lengths). The process through which colour vision evolved in Arthropoda is still uncertain, in particular, it is unclear whether gene duplications allowing arthropods to distinguish colours originated prior to the origin of the Arthropoda. We have already obtained genomic data for a variety of key (previously unsampled) ecdysozoan lineages, including many arthropods and representatives of other Phyla.

Objectives: This project aims at clarifying Opsin evolution in Ecdysozoa, particularly with reference to the origin of colour vision in Arthropoda. More precisely, we shall test (1) hypotheses of the relationships of the visual Opsins found in the velvet worms (the closest sister group of the Arthropoda). Further to that (2) we shall investigate the evolution of the Opsins found in other ecdysozoan lineages. This will allow a complete clarification of the evolutionary origins of colour vision in Arthropoda and its history in Ecdysozoa. This will allow for a better understanding of the evolutionary success of Arthropoda more broadly.

1) Feuda R., Hamilton, S.C., McInerney, J. and Pisani D. (2012) Opsin evolution reveal a simple route to animal vision. Proceedings of the National Academy of Sciences USA. Published Online ahead of press.

2) Campbell L.I., Rota-Stabelli O., Longhorn. S., Edgecombe. G., Telford, M., Rebecchi, L., Peterson. K.J. & Pisani. D. (2011) MicroRNAs and phylogenomics resolve the phylogenetic relationships of the Tardigrada and suggest the velvet worms as the sister group of the Arthropoda. Proceedings of the National Academy of Sciences USA 108:15920-15924.