

Abstract

Vision plays a key role in life of many vertebrates, and the performance of visual system is often adapted to specific environments inhabited by individual species. Fish colonized a wide range of habitats and adjusted their visual abilities to maximize their success rates in hunting, reproduction and predator avoidance. This thesis is focused on molecular mechanism of visual system, namely on genes for photoreceptor proteins, opsins, of two major groups of teleost fishes: African riverine cichlids (family Cichlidae, order Cichliformes, part of larger taxa Percomorpha), and European freshwater cyprinids (family Cyprinidae, order Cypriniformes, part of larger taxa Ostariophysi). Two types of photoreceptor cells are present on retina: the cones and the rods. Actinopterygian fishes in general have four cone opsin types (SWS1, SWS2, RH2 and LWS) used for colour (photopic) vision, and one rod opsin type (rhodopsins) for vision in deteriorated light conditions (scotopic vision). In the present thesis, I focus on 1) DNA sequence and amino acid substitutions of the opsin genes, and on 2) gene expression levels of opsins sensitive to various wavelengths of light spectrum. The results of my work show that both cichlids (family Cichlidae) and cyprinids (family Cyprinidae) have a complete set of opsin genes in their genome, including four types of cone opsins and one type of rod opsins. These genes are then expressed differently among species. Species with dominant red (LWS) opsin expression prevail in both groups; furthermore, this condition most likely seems to be ancestral for whole group of African cichlids. Cichlids express 4 to 5 cone opsin genes, and in cyprinids, there were 4 to 7 of these genes expressed. I have found different expression levels among species studied, both in cichlids and cyprinids. Aside from expression profiles of adult fish in cyprinid species, I am focusing on expression level differences between adult fish and their larval stages. I have shown that expression profiles of larval stages differ from expression profiles of adults, with higher levels of short wavelength opsins in the larval stages (SWS1 and SWS2, sensitive from UV to blue part of the spectra), which corresponds to previous observations within distantly related cichlids; thus it could be of common and possibly more general feature among fishes.

Key words: vision, photoreceptors, opsins, cichlids, cyprinids, developmental plasticity