

## GEPHE SUMMARY

**Gephebase Gene**  
opsin - rhodopsin1 (RH1)

**Entry Status**  
Published

**GepheID**  
GP00000786

**Main curator**  
Martin

## PHENOTYPIC CHANGE

**Trait Category**  
Physiology

**Trait**  
Color vision (blue-shift)

**Trait State in Taxon A**  
Cichlid fishes; shallow waters

**Trait State in Taxon B**  
Cichlid fishes; deep waters

**Ancestral State**  
Data not curated

**Taxonomic Status**  
Intergeneric or Higher

	Taxon A	Taxon B
<b>Latin Name</b>	<i>African cichlids</i>	<i>African cichlids</i>
<b>Common Name</b>	-	-
<b>Synonyms</b>	-	-
<b>Rank</b>	no rank	no rank
<b>Lineage</b>	cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Deuterostomia; Chordata; Craniata; Vertebrata; Gnathostomata; Teleostomi; Euteleostomi; Actinopterygii; Actinopteri; Neopterygii; Teleostei; Osteoglossocephalai; Clupecocephala; Euteleosteomorpha; Neoteleostei; Eurypterygia; Ctenosquamata; Acanthomorpha; Euacanthomorpha; Percormorphaceae; Ovalentaria; Cichlomorphae; Cichliformes; Cichlidae	cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Deuterostomia; Chordata; Craniata; Vertebrata; Gnathostomata; Teleostomi; Euteleostomi; Actinopterygii; Actinopteri; Neopterygii; Teleostei; Osteoglossocephalai; Clupecocephala; Euteleosteomorpha; Neoteleostei; Eurypterygia; Ctenosquamata; Acanthomorpha; Euacanthomorpha; Percormorphaceae; Ovalentaria; Cichlomorphae; Cichliformes; Cichlidae
<b>Parent</b>	Cichlidae (cichlids) - (Rank: family)	Cichlidae (cichlids) - (Rank: family)
<b>NCBI Taxonomy ID</b>	319095	319095
<b>is Taxon A an Intraspecies?</b>	No	No

## GENOTYPIC CHANGE

**Generic Gene Name**  
RHO

**Synonyms**  
RP4; OPN2; CSNBAD1

**String**  
9606.ENSP00000296271

**Sequence Similarities**  
Belongs to the G-protein coupled receptor 1 family. Opsin subfamily.

**GO - Molecular Function**  
GO:0046872 : metal ion binding  
GO:0004930 : G protein-coupled receptor activity  
GO:0008020 : G protein-coupled photoreceptor activity  
GO:0005502 : 11-cis retinal binding

**GO - Biological Process**  
GO:0007186 : G protein-coupled receptor signaling pathway  
GO:0001523 : retinoid metabolic process  
GO:0006468 : protein phosphorylation  
GO:0018298 : protein-chromophore linkage

**UniProtKB Homo sapiens**  
P08100

**GenebankID or UniProtKB**

GO:0007601 : visual perception  
GO:0071482 : cellular response to light stimulus  
GO:0007602 : phototransduction  
GO:0016038 : absorption of visible light  
GO:0045494 : photoreceptor cell maintenance  
GO:0007603 : phototransduction, visible light  
GO:0022400 : regulation of rhodopsin mediated signaling pathway  
GO:0060041 : retina development in camera-type eye  
GO:0016056 : rhodopsin mediated signaling pathway

#### GO - Cellular Component

GO:0016021 : integral component of membrane  
GO:0005886 : plasma membrane  
GO:0000139 : Golgi membrane  
GO:0005887 : integral component of plasma membrane  
GO:0005794 : Golgi apparatus  
GO:0005911 : cell-cell junction  
GO:0001750 : photoreceptor outer segment  
GO:0097381 : photoreceptor disc membrane  
GO:0060170 : ciliary membrane  
GO:0030660 : Golgi-associated vesicle membrane  
GO:0001917 : photoreceptor inner segment  
GO:0060342 : photoreceptor inner segment membrane  
GO:0042622 : photoreceptor outer segment membrane

#### Presumptive Null

No

#### Molecular Type

Coding

#### Aberration Type

SNP

#### SNP Coding Change

Nonsynonymous

#### Molecular Details of the Mutation

A292S and reversals; many independent cases

#### Experimental Evidence

Candidate Gene

	Taxon A	Taxon B	Position
Codon	-	-	-
Amino-acid	-	-	-

#### Main Reference

Parallelism of amino acid changes at the RH1 affecting spectral sensitivity among deep-water cichlids from Lakes Tanganyika and Malawi. (2005)

#### Authors

Sugawara T; Terai Y; Imai H; Turner GF; Koblmüller S; Sturmbauer C; Shichida Y; Okada N

#### Abstract

Many examples of the appearance of similar traits in different lineages are known during the evolution of organisms. However, the underlying genetic mechanisms have been elucidated in very few cases. Here, we provide a clear example of evolutionary parallelism, involving changes in the same genetic pathway, providing functional adaptation of RH1 pigments to deep-water habitats during the adaptive radiation of East African cichlid fishes. We determined the RH1 sequences from 233 individual cichlids. The reconstruction of cichlid RH1 pigments with 11-cis-retinal from 28 sequences showed that the absorption spectra of the pigments of nine species were shifted toward blue, tuned by two particular amino acid replacements. These blue-shifted RH1 pigments might have evolved as adaptations to the deep-water photic environment. Phylogenetic evidence indicates that one of the replacements, A292S, has evolved several times independently, inducing similar functional change. The parallel evolution of the same mutation at the same amino acid position suggests that the number of genetic changes underlying the appearance of similar traits in cichlid diversification may be fewer than previously expected.

#### Additional References

Reverse evolution in RH1 for adaptation of cichlids to water depth in Lake Tanganyika. (2011)

## RELATED GEPHE

#### Related Genes

3 (opsin - (SWS2B), Rx1, opsin - rhodopsin (LWS))

#### Related Haplotypes

No matches found.

## COMMENTS

Needs curation

