

GEPHE SUMMARY

opsin - rhodopsin1 (RH1) (https://www.gephebase.org/search-criteria?/and+Gene)		Gephebase Gene	GP00000786	GepheID
Gephebase="opsin - rhodopsin1 (RH1)"#gephebase-summary-title)				Main curator
Published		Entry Status	Martin	

PHENOTYPIC CHANGE

Physiology (https://www.gephebase.org/search-criteria?/and+Trait)		Trait Category		
Category="Physiology"#gephebase-summary-title)				
Color vision (blue-shift) (<a color"="" href="https://www.gephebase.org/search-criteria?/and+Trait=">https://www.gephebase.org/search-criteria?/and+Trait="Color)		Trait		
vision (blue-shift)"#gephebase-summary-title)				
Cichlid fishes; shallow waters		Trait State in Taxon A		
Cichlid fishes; deep waters		Trait State in Taxon B		
Data not curated		Ancestral State		
Intergenic or Higher (https://www.gephebase.org/search-criteria?/and+Taxonomic)		Taxonomic Status		
Status="Intergenic or Higher"#gephebase-summary-title)				
Taxon A			Taxon B	
African cichlids		Latin Name	African cichlids	Latin Name
(https://www.gephebase.org/search-criteria?/and+Taxon and Synonyms="African cichlids"#gephebase-summary-title)			(https://www.gephebase.org/search-criteria?/and+Taxon and Synonyms="African cichlids"#gephebase-summary-title)	
-		Common Name	-	Common Name
-		Synonyms	-	Synonyms
no rank		Rank	no rank	Rank
cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Deuterostomia; Chordata; Craniata; Vertebrata; Gnathostomata; Teleostomi; Euteleostomi; Actinopterygii; Actinopteri; Neopterygii; Teleostei; Osteoglossocephalai; Clupeocephala; Euteleosteorpha; Neoteleostei; Eurypterygia; Ctenosquamata; Acanthomorpha; Euacanthomorpha; Percormorphaceae; Ovalentaria; Cichlomorphae; Cichliformes; Cichlidae		Lineage	cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Deuterostomia; Chordata; Craniata; Vertebrata; Gnathostomata; Teleostomi; Euteleostomi; Actinopterygii; Actinopteri; Neopterygii; Teleostei; Osteoglossocephalai; Clupeocephala; Euteleosteorpha; Neoteleostei; Eurypterygia; Ctenosquamata; Acanthomorpha; Euacanthomorpha; Percormorphaceae; Ovalentaria; Cichlomorphae; Cichliformes; Cichlidae	Lineage
Cichlidae (cichlids) - (Rank: family)		Parent	Cichlidae (cichlids) - (Rank: family)	Parent
(https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=8113)		NCBI Taxonomy ID	(https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=8113)	NCBI Taxonomy ID
319095			319095	
(https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=319095)			(https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=319095)	
No		is Taxon A an Intraspecies?	No	is Taxon B an Intraspecies?

GENOTYPIC CHANGE

RHO		Generic Gene Name	P08100 (http://www.uniprot.org/uniprot/P08100)	UniProtKB Homo sapiens
RP4; OPN2; CSNBAD1		Synonyms	0	GenebankID or UniProtKB
9606.ENSPP0000296271		String		
(http://string-db.org/newstring.cgi/show_network_section.pl?identifier=9606.ENSPP0000296271)				
Belongs to the G-protein coupled receptor 1 family. Opsin subfamily.		Sequence Similarities		
GO:0046872 : metal ion binding (https://www.ebi.ac.uk/QuickGO/term/GO:0046872)		GO - Molecular Function		
GO:0004930 : G protein-coupled receptor activity (https://www.ebi.ac.uk/QuickGO/term/GO:0004930)				
GO:0008020 : G protein-coupled photoreceptor activity (https://www.ebi.ac.uk/QuickGO/term/GO:0008020)				

GO:0005502 : 11-cis retinal binding (<https://www.ebi.ac.uk/QuickGO/term/GO:0005502>)

GO - Biological Process

GO:0007186 : G protein-coupled receptor signaling pathway

(<https://www.ebi.ac.uk/QuickGO/term/GO:0007186>)

GO:0001523 : retinoid metabolic process

(<https://www.ebi.ac.uk/QuickGO/term/GO:0001523>)

GO:0006468 : protein phosphorylation

(<https://www.ebi.ac.uk/QuickGO/term/GO:0006468>)

GO:0018298 : protein-chromophore linkage

(<https://www.ebi.ac.uk/QuickGO/term/GO:0018298>)

GO:0007601 : visual perception (<https://www.ebi.ac.uk/QuickGO/term/GO:0007601>)

GO:0071482 : cellular response to light stimulus

(<https://www.ebi.ac.uk/QuickGO/term/GO:0071482>)

GO:0007602 : phototransduction (<https://www.ebi.ac.uk/QuickGO/term/GO:0007602>)

GO:0016038 : absorption of visible light

(<https://www.ebi.ac.uk/QuickGO/term/GO:0016038>)

GO:0045494 : photoreceptor cell maintenance

(<https://www.ebi.ac.uk/QuickGO/term/GO:0045494>)

GO:0007603 : phototransduction, visible light

(<https://www.ebi.ac.uk/QuickGO/term/GO:0007603>)

GO:0022400 : regulation of rhodopsin mediated signaling pathway

(<https://www.ebi.ac.uk/QuickGO/term/GO:0022400>)

GO:0060041 : retina development in camera-type eye

(<https://www.ebi.ac.uk/QuickGO/term/GO:0060041>)

GO:0016056 : rhodopsin mediated signaling pathway

(<https://www.ebi.ac.uk/QuickGO/term/GO:0016056>)

GO - Cellular Component

GO:0016021 : integral component of membrane

(<https://www.ebi.ac.uk/QuickGO/term/GO:0016021>)

GO:0005886 : plasma membrane (<https://www.ebi.ac.uk/QuickGO/term/GO:0005886>)

GO:0000139 : Golgi membrane (<https://www.ebi.ac.uk/QuickGO/term/GO:0000139>)

GO:0005887 : integral component of plasma membrane

(<https://www.ebi.ac.uk/QuickGO/term/GO:0005887>)

GO:0005794 : Golgi apparatus (<https://www.ebi.ac.uk/QuickGO/term/GO:0005794>)

GO:0005911 : cell-cell junction (<https://www.ebi.ac.uk/QuickGO/term/GO:0005911>)

GO:0001750 : photoreceptor outer segment

(<https://www.ebi.ac.uk/QuickGO/term/GO:0001750>)

GO:0097381 : photoreceptor disc membrane

(<https://www.ebi.ac.uk/QuickGO/term/GO:0097381>)

GO:0060170 : ciliary membrane (<https://www.ebi.ac.uk/QuickGO/term/GO:0060170>)

GO:0030660 : Golgi-associated vesicle membrane

(<https://www.ebi.ac.uk/QuickGO/term/GO:0030660>)

GO:0001917 : photoreceptor inner segment

(<https://www.ebi.ac.uk/QuickGO/term/GO:0001917>)

GO:0060342 : photoreceptor inner segment membrane

(<https://www.ebi.ac.uk/QuickGO/term/GO:0060342>)

GO:0042622 : photoreceptor outer segment membrane

(<https://www.ebi.ac.uk/QuickGO/term/GO:0042622>)

Presumptive Null

No ([#gephebase-summary-title](https://www.gephebase.org/search-criteria?/and+Presumptive+Null=))

Molecular Type

Coding ([#gephebase-summary-title](https://www.gephebase.org/search-criteria?/and+Molecular+Type=))

Aberration Type

SNP ([#gephebase-summary-title](https://www.gephebase.org/search-criteria?/and+Aberration+Type=))

SNP Coding Change

Nonsynonymous

Molecular Details of the Mutation

A292S and reversals; many independent cases

Experimental Evidence

Candidate Gene ([#gephebase-summary-title](https://www.gephebase.org/search-criteria?/and+Experimental+Evidence=))

	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) (<https://pubmed.ncbi.nlm.nih.gov/15809435>)

Authors

Sugawara T; Terai Y; Imai H; Turner GF; Koblmã¼ller 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) (<https://pubmed.ncbi.nlm.nih.gov/21172834>)

RELATED GEPHE

Related Genes

3 (opsin - (SWS2B), Rx1, opsin - rhodopsin (LWS)) (https://www.gephebase.org/search-criteria?/or+Taxon ID=*319095*/and+Trait=Color vision/and+groupHaplotypes=true#gephebase-summary-title)

Related Haplotypes

No matches found.

EXTERNAL LINKS

COMMENTS

Needs curation