

GEPHE SUMMARY

	Gephebase Gene		GepheID
opsin - (SWS2B) (<a +opsin+"(sws2b)"#gephebase-summary-title"="" href="https://www.gephebase.org/search-criteria?/and+GeneGephebase=">https://www.gephebase.org/search-criteria?/and+GeneGephebase="+opsin+"(SWS2B)"#gephebase-summary-title)		GP00001440	
	Entry Status	Martin	Main curator
Published			

PHENOTYPIC CHANGE

	Trait Category	
Physiology (<a +physiology"#gephebase-summary-title"="" href="https://www.gephebase.org/search-criteria?/and+TraitCategory=">https://www.gephebase.org/search-criteria?/and+TraitCategory="+Physiology"#gephebase-summary-title)		
	Trait	
Color vision (<a +colorvision"#gephebase-summary-title"="" href="https://www.gephebase.org/search-criteria?/and+Trait=">https://www.gephebase.org/search-criteria?/and+Trait="+Colorvision"#gephebase-summary-title)		
	Trait State in Taxon A	
-		
	Trait State in Taxon B	
-		
	Ancestral State	
Unknown		
	Taxonomic Status	
Interspecific (<a +interspecific"#gephebase-summary-title"="" href="https://www.gephebase.org/search-criteria?/and+TaxonomicStatus=">https://www.gephebase.org/search-criteria?/and+TaxonomicStatus="+Interspecific"#gephebase-summary-title)		

Taxon A		Taxon B	
	Latin Name		Latin Name
Aulonocara baenschi (<a +aulonocara+baenschi"#gephebase-summary-title"="" href="https://www.gephebase.org/search-criteria?/and+Taxon+and+Synonyms=">https://www.gephebase.org/search-criteria?/and+Taxon+and+Synonyms="+Aulonocara+baenschi"#gephebase-summary-title)		Tramitichromis intermedius (<a +tramitichromis+intermedius"#gephebase-summary-title"="" href="https://www.gephebase.org/search-criteria?/and+Taxon+and+Synonyms=">https://www.gephebase.org/search-criteria?/and+Taxon+and+Synonyms="+Tramitichromis+intermedius"#gephebase-summary-title)	
	Common Name		Common Name
Nkhomo-benga peacock cichlid		-	
	Synonyms		Synonyms
Nkhomo-benga peacock cichlid; Nkhomo-benga peacock; Aulonocara baenschi Meyer & Riehl, 1985		-	
	Rank		Rank
species		species	
	Lineage		Lineage
cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Deuterostomia; Chordata; Craniata; Vertebrata; Gnathostomata; Teleostomi; Euteleostomi; Actinopterygii; Actinopteri; Neopterygii; Teleostei; Osteoglossocephalai; Clupeocephala; Euteleosteomorpha; Neoteleostei; Eurypterygia; Ctenosquamata; Acanthomorpha; Euacanthomorphacea; Percomorphaceae; Ovalentaria; Cichlomorphae; Cichliformes; Cichlidae; African cichlids; Pseudocrenilabrinae; Haplochromini; Aulonocara		cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Deuterostomia; Chordata; Craniata; Vertebrata; Gnathostomata; Teleostomi; Euteleostomi; Actinopterygii; Actinopteri; Neopterygii; Teleostei; Osteoglossocephalai; Clupeocephala; Euteleosteomorpha; Neoteleostei; Eurypterygia; Ctenosquamata; Acanthomorpha; Euacanthomorphacea; Percomorphaceae; Ovalentaria; Cichlomorphae; Cichliformes; Cichlidae; African cichlids; Pseudocrenilabrinae; Haplochromini; Tramitichromis	
	Parent		Parent
Aulonocara () - (Rank: genus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 27780)		Tramitichromis () - (Rank: genus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 136859)	
	NCBI Taxonomy ID		NCBI Taxonomy ID
143496 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 143496)		323801 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 323801)	
	is Taxon A an Intraspecies?		is Taxon B an Intraspecies?
No		No	

GENOTYPIC CHANGE

	Generic Gene Name		UniProtKB Danio rerio
opn1sw2		Q9W6A8 (http://www.uniprot.org/uniprot/Q9W6A8)	
	Synonyms		GenebankID or UniProtKB
SWS2; bluops; zfbblue; Sl:zK13A21.5; opn1sw1; sws2		0	
	String		
7955.ENS DARP00000019477 (http://string-db.org/newstring.cgi/show_network_section.pl?identifier=7955.ENS DARP00000019477)			
	Sequence Similarities		
Belongs to the G-protein coupled receptor 1 family. Opsin subfamily.			
	GO - Molecular Function		
GO:0009882 : blue light photoreceptor activity (https://www.ebi.ac.uk/QuickGO/term/GO:0009882)			
GO:0008020 : G protein-coupled photoreceptor activity (https://www.ebi.ac.uk/QuickGO/term/GO:0008020)			

GO:0007186 : G protein-coupled receptor signaling pathway
(<https://www.ebi.ac.uk/QuickGO/term/GO:0007186>)
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 - Cellular Component
GO:0005887 : integral component of plasma membrane
(<https://www.ebi.ac.uk/QuickGO/term/GO:0005887>)
GO:0001750 : photoreceptor outer segment
(<https://www.ebi.ac.uk/QuickGO/term/GO:0001750>)

Presumptive Null

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

Molecular Type

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

Aberration Type

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

SNP Coding Change

Nonsynonymous

Molecular Details of the Mutation

Ala269Thr causing a 10nm Spectral Sensitivity Shift

Experimental Evidence

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

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

Main Reference

Evolution of cichlid vision via trans-regulatory divergence. (2012) (<https://pubmed.ncbi.nlm.nih.gov/23267665>)

Authors

O’Quin KE; Schulte JE; Patel Z; Kahn N; Naseer Z; Wang H; Conte MA; Carleton KL

Abstract

Phenotypic evolution may occur through mutations that affect either the structure or expression of protein-coding genes. Although the evolution of color vision has historically been attributed to structural mutations within the opsin genes, recent research has shown that opsin regulatory mutations can also tune photoreceptor sensitivity and color vision. Visual sensitivity in African cichlid fishes varies as a result of the differential expression of seven opsin genes. We crossed cichlid species that express different opsin gene sets and scanned their genome for expression Quantitative Trait Loci (eQTL) responsible for these differences. Our results shed light on the role that different structural, cis-, and trans-regulatory mutations play in the evolution of color vision.

We identified 11 eQTL that contribute to the divergent expression of five opsin genes. On three linkage groups, several eQTL formed regulatory “hotspots” associated with the expression of multiple opsins. Importantly, however, the majority of the eQTL we identified (8/11 or 73%) occur on linkage groups located trans to the opsin genes, suggesting that cichlid color vision has evolved primarily via trans-regulatory divergence. By modeling the impact of just two of these trans-regulatory eQTL, we show that opsin regulatory mutations can alter cichlid photoreceptor sensitivity and color vision at least as much as opsin structural mutations can.

Combined with previous work, we demonstrate that the evolution of cichlid color vision results from the interplay of structural, cis-, and especially trans-regulatory loci. Although there are numerous examples of structural and cis-regulatory mutations that contribute to phenotypic evolution, our results suggest that trans-regulatory mutations could contribute to phenotypic divergence more commonly than previously expected, especially in systems like color vision, where compensatory changes in the expression of multiple genes are required in order to produce functional phenotypes.

Additional References

RELATED GEPHE

Related Genes

1 (Rx1) (<https://www.gephebase.org/search-criteria?/or+Taxon ID=~143496~/and+Trait=Color vision/or+Taxon ID=~323801~/and+Trait=Color vision/and+groupHaplotypes=true#gephebase-summary-title>)

Related Haplotypes

No matches found.

EXTERNAL LINKS

COMMENTS

