GEPHE SUMMARY

Gephebase Gene
Rx1 (https://www.gephebase.org/search-criteria?/and+Gene Gephebase=^Rx1^#gephebase-summary-title)

GepheID
GP00001441

Entry Status
Published

Main curator
Martin

PHENOTYPIC CHANGE

Trait Category
Physiology (https://www.gephebase.org/search-criteria?/and+Trait Category=^Physiology^#gephebase-summary-title)

Trait
Color vision (expression of SWS2b opsin) (https://www.gephebase.org/search-criteria?/and+Trait=^Color vision (expression of SWS2b opsin)^#gephebase-summary-title)

Trait State in Taxon A
Expresses predominantly SWS2B

Trait State in Taxon B
Expresses predominantly SWS2A

Ancestral State
Unknown

Taxonomic Status
Interspecific (https://www.gephebase.org/search-criteria?/and+Taxonomic Status=^Interspecific^#gephebase-summary-title)

Taxon A

Latin Name
Aulonocara baenschi (https://www.gephebase.org/search-criteria?/and+Taxon and Synonyms=^Aulonocara baenschi^#gephebase-summary-title)

Common Name
Nkhomo-benga peacock cichlid

Synonyms
Nkhomo-benga peacock cichlid; Nkhomo-benga peacock; Aulonocara baenschi Meyer & Riehl, 1985

Rank
species

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; Acanthomorphata; Euacanthomorphacea; Percomorphaceae; Ovalentaria; Cichlomorphae; Cichliformes; Cichlidae; African cichlids; Pseudocrenilabrinae; Haplochromini; Aulonocara

Parent
Aulonocara () - (Rank: genus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 27780)

NCBI Taxonomy ID
143496 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 143496)

is Taxon A an Infraspecies?
No

Taxon B

Latin Name
Tramitichromis intermedius (https://www.gephebase.org/search-criteria?/and+Taxon and Synonyms=^Tramitichromis intermedius^#gephebase-summary-title)

Common Name
-

Synonyms
-

Rank
species

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; Acanthomorphata; Euacanthomorphacea; Percomorphaceae; Ovalentaria; Cichlomorphae; Cichliformes; Cichlidae; African cichlids; Pseudocrenilabrinae; Haplochromini; Tramitichromis

Parent
Tramitichromis () - (Rank: genus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 136859)

NCBI Taxonomy ID
323801 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 323801)

is Taxon B an Infraspecies?
No

GENOTYPIC CHANGE

Generic Gene Name
rx1

Synonyms
-

String
7955.ENSDARP00000096944 (http://string-db.org/newstring_cgi/show_network_section.pl?identifier=7955.ENSDARP00000096944)

Sequence Similarities
Belongs to the paired homeobox family. Bicoid subfamily.

GO - Molecular Function
GO:0003700 : DNA-binding transcription factor activity (https://www.ebi.ac.uk/QuickGO/term/GO:0003700)
GO:0043565 : sequence-specific DNA binding (https://www.ebi.ac.uk/QuickGO/term/GO:0043565)

UniProtKB Danio rerio
O42356 (http://www.uniprot.org/uniprot/O42356)

GenebankID or UniProtKB
()

GO - Biological Process

GO:0003407 : neural retina development
(https://www.ebi.ac.uk/QuickGO/term/GO:0003407)
GO:0006366 : transcription by RNA polymerase II
(https://www.ebi.ac.uk/QuickGO/term/GO:0006366)
GO:0060219 : camera-type eye photoreceptor cell differentiation
(https://www.ebi.ac.uk/QuickGO/term/GO:0060219)
GO:0010842 : retina layer formation (https://www.ebi.ac.uk/QuickGO/term/GO:0010842)

GO - Cellular Component

GO:0005634 : nucleus (https://www.ebi.ac.uk/QuickGO/term/GO:0005634)

Presumptive Null

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

Molecular Type

Cis-regulatory (https://www.gephebase.org/search-criteria?/and+Molecular Type=^Cis-regulatory^#gephebase-summary-title)

Aberration Type

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

Indel Size

100-999 bp

Molecular Details of the Mutation

413bp deletion located 2.5-kb upstream of the Rx1 translation start site correlating with decreased Rx1 expression

Experimental Evidence

Linkage Mapping (https://www.gephebase.org/search-criteria?/and+Experimental Evidence=^Linkage Mapping^#gephebase-summary-title)

Main Reference

Interspecific variation in Rx1 expression controls opsin expression and causes visual system diversity in African cichlid fishes. (2014) (https://pubmed.ncbi.nlm.nih.gov/24859246)

Authors

Schulte JE; O'Brien CS; Conte MA; O'Quin KE; Carleton KL

Abstract

The mechanisms underlying natural phenotypic diversity are key to understanding evolution and speciation. Cichlid fishes are among the most speciose vertebrates and an ideal model for identifying genes controlling species differences. Cichlids have diverse visual sensitivities that result from species expressing subsets of seven cichlid cone opsin genes. We previously identified a quantitative trait locus (QTL) that tunes visual sensitivity by varying SWS2A (short wavelength sensitive 2A) opsin expression in a genetic cross between two Lake Malawi cichlid species. Here, we identify Rx1 (retinal and anterior neural fold homeobox) as the causative gene for the QTL using fine mapping and RNAseq in retinal transcriptomes. Rx1 is differentially expressed between the parental species and correlated with SWS2A expression in the F2 progeny. Expression of Rx1 and SWS2A is also correlated in a panel of 16 Lake Malawi cichlid species. Association mapping in this panel identified a 413-bp deletion located 2.5-kb upstream of the Rx1 translation start site that is correlated with decreased Rx1 expression. This deletion explains 62% of the variance in SWS2A expression across 53 cichlid species in 29 genera. The deletion occurs in both the sand and rock-dwelling cichlid clades, suggesting that it is an ancestral polymorphism. Our finding supports the hypothesis that mixing and matching of ancestral polymorphisms can explain the diversity of present day cichlid phenotypes.

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Additional References

RELATED GEPHE

Related Genes

1 (opsin - (SWS2B)) (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

Deletion occurs in both the sand and rock-dwelling cichlid clades suggesting ILS of an ancestral polymorphism or introgressions - @Introgression @ILS