GEPHE SUMMARY

Gephebase Gene
Patched1 (Ptc1) (https://www.gephebase.org/search-criteria?/and+Gene Gephebase=^Patched1 (Ptc1)^#gephebase-summary-title)

GepheID
GP00000856

Entry Status
Published

Main curator
Martin

PHENOTYPIC CHANGE

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

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

Trait State in Taxon A
Labeotropheus trewavasae

Trait State in Taxon B
Metriaclima mbenjii

Ancestral State
Taxon A

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

Taxon A

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

Common Name
blue mbuna

Synonyms
blue mbuna; Labeotropheus fuelleborni Ahl, 1926

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; Labeotropheus

Parent
Labeotropheus () - (Rank: genus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 57306)

NCBI Taxonomy ID
57307 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 57307)

is Taxon A an Infraspecies?
No

Taxon B

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

Common Name
-

Synonyms
Maylandia mbenji; Metriaclima mbenji; Metriaclima mbenjii; Maylandia mbenjii (Stauffer, Bowers, Kellogg & McKaye, 1997); Metriaclima mbenjii Stauffer, Bowers, Kellogg & McKaye, 1997

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; Maylandia

Parent
Maylandia () - (Rank: genus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 143623)

NCBI Taxonomy ID
441518 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 441518)

is Taxon B an Infraspecies?
No

GENOTYPIC CHANGE

Generic Gene Name
ptch1

Synonyms
ptc1

String
7955.ENSDARP00000071771 (http://string-db.org/newstring_cgi/show_network_section.pl?identifier=7955.ENSDARP00000071771)

Sequence Similarities
Belongs to the patched family.

GO - Molecular Function
GO:0097108 : hedgehog family protein binding (https://www.ebi.ac.uk/QuickGO/term/GO:0097108)
GO:0008158 : hedgehog receptor activity

UniProtKB Danio rerio
Q98864 (http://www.uniprot.org/uniprot/Q98864)

GenebankID or UniProtKB
AGO03751 (https://www.ncbi.nlm.nih.gov/nuccore/AGO03751)

(https://www.ebi.ac.uk/QuickGO/term/GO:0008158)
GO:0005119 : smoothened binding (https://www.ebi.ac.uk/QuickGO/term/GO:0005119)

GO - Biological Process

GO:0001649 : osteoblast differentiation
(https://www.ebi.ac.uk/QuickGO/term/GO:0001649)
GO:0010002 : cardioblast differentiation
(https://www.ebi.ac.uk/QuickGO/term/GO:0010002)
GO:0043010 : camera-type eye development
(https://www.ebi.ac.uk/QuickGO/term/GO:0043010)
GO:0045879 : negative regulation of smoothened signaling pathway
(https://www.ebi.ac.uk/QuickGO/term/GO:0045879)
GO:0048635 : negative regulation of muscle organ development
(https://www.ebi.ac.uk/QuickGO/term/GO:0048635)
GO:0009954 : proximal/distal pattern formation
(https://www.ebi.ac.uk/QuickGO/term/GO:0009954)
GO:0031290 : retinal ganglion cell axon guidance
(https://www.ebi.ac.uk/QuickGO/term/GO:0031290)
GO:0007224 : smoothened signaling pathway
(https://www.ebi.ac.uk/QuickGO/term/GO:0007224)

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)

Presumptive Null

Unknown (https://www.gephebase.org/search-criteria?/and+Presumptive Null=^Unknown^#gephebase-summary-title)

Molecular Type

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

Aberration Type

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

Molecular Details of the Mutation

Uncharacterized cis-regulatory change - with ancestral Labeotropheus (LF) allele exhibiting relatively higher levels of expression

Experimental Evidence

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

Main Reference

Craniofacial divergence and ongoing adaptation via the hedgehog pathway. (2011) (https://pubmed.ncbi.nlm.nih.gov/21788496)

Authors

Roberts RB; Hu Y; Albertson RC; Kocher TD

Abstract

Adaptive variation in craniofacial structure contributes to resource specialization and speciation, but the genetic loci that underlie craniofacial adaptation remain unknown. Here we show that alleles of the hedgehog pathway receptor Patched1 (Ptch1) gene are responsible for adaptive variation in the shape of the lower jaw both within and among genera of Lake Malawi cichlid fish. The evolutionarily derived allele of Ptch1 reduces the length of the retroarticular (RA) process of the lower jaw, a change predicted to increase speed of jaw rotation for improved suction-feeding. The alternate allele is associated with a longer RA and a more robustly mineralized jaw, typical of species that use a biting mode of feeding. Genera with the most divergent feeding morphologies are nearly fixed for different Ptch1 alleles, whereas species with intermediate morphologies still segregate variation at Ptch1. Thus, the same alleles that help to define macroevolutionary divergence among genera also contribute to microevolutionary fine-tuning of adaptive traits within some species. Variability of craniofacial morphology mediated by Ptch1 polymorphism has likely contributed to niche partitioning and ecological speciation of these fishes.

Additional References

Hedgehog signaling mediates adaptive variation in a dynamic functional system in the cichlid feeding apparatus. (2014) (https://pubmed.ncbi.nlm.nih.gov/24912175)

RELATED GEPHE

Related Genes

2 (BMP4 (uncertain), lbh (limb bud and heart homolog)) (https://www.gephebase.org/search-criteria?/or+Taxon ID=^57307^/and+Trait=Cranio-facial morphology/or+Taxon ID=^441518^/and+Trait=Cranio-facial morphology/and+groupHaplotypes=true#gephebase-summary-title)

Related Haplotypes

No matches found.

EXTERNAL LINKS

COMMENTS

QTL exhibited an additive mode of inheritance and accounted for 17% of the phenotypic variance in the F2 population