

GEPHE SUMMARY

|                                                                                                                                                                                                   |  |              |  |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--------------|--|
| Gephebase Gene                                                                                                                                                                                    |  | GepheID      |  |
| BMP4 (uncertain) ( <a href="https://www.gephebase.org/search-criteria?/and+Gene">https://www.gephebase.org/search-criteria?/and+Gene</a><br>Gephebase="BMP4 (uncertain)"#gephebase-summary-title) |  | GP00000153   |  |
| Entry Status                                                                                                                                                                                      |  | Martin       |  |
| Published                                                                                                                                                                                         |  | Main curator |  |

PHENOTYPIC CHANGE

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |  |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| Trait Category                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |  |
| Morphology ( <a href="https://www.gephebase.org/search-criteria?/and+Trait">https://www.gephebase.org/search-criteria?/and+Trait</a><br>Category="Morphology"#gephebase-summary-title)                                                                                                                                                                                                                                                                                                                  |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |  |
| Trait                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |  |
| Cranio-facial morphology ( <a cranio-facial="" href="https://www.gephebase.org/search-criteria?/and+Trait=" morphology"#gephebase-summary-title"="">https://www.gephebase.org/search-criteria?/and+Trait="Cranio-facial morphology"#gephebase-summary-title</a> )                                                                                                                                                                                                                                       |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |  |
| Trait State in Taxon A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |  |
| Labeotropheus fuelleborni                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |  |
| Trait State in Taxon B                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |  |
| Metriaclima zebra                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |  |
| Ancestral State                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |  |
| Data not curated                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |  |
| Taxonomic Status                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |  |
| Interspecific ( <a href="https://www.gephebase.org/search-criteria?/and+Taxonomic">https://www.gephebase.org/search-criteria?/and+Taxonomic</a><br>Status="Interspecific"#gephebase-summary-title)                                                                                                                                                                                                                                                                                                      |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |  |
| Taxon A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |  | Taxon B                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |  |
| Latin Name                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |  | Latin Name                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |  |
| Labeotropheus fuelleborni<br>( <a fuelleborni"#gephebase-summary-title"="" href="https://www.gephebase.org/search-criteria?/and+Taxon and Synonyms=" labeotropheus="">https://www.gephebase.org/search-criteria?/and+Taxon and Synonyms="Labeotropheus fuelleborni"#gephebase-summary-title</a> )                                                                                                                                                                                                       |  | Maylandia zebra<br>( <a href="https://www.gephebase.org/search-criteria?/and+Taxon and Synonyms=" maylandia="" zebra"#gephebase-summary-title"="">https://www.gephebase.org/search-criteria?/and+Taxon and Synonyms="Maylandia zebra"#gephebase-summary-title</a> )                                                                                                                                                                                                                                                          |  |
| Common Name                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |  | Common Name                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |  |
| blue mbuna                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |  | zebra mbuna                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |  |
| Synonyms                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |  | Synonyms                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |  |
| blue mbuna; Labeotropheus fuelleborni Ahl, 1926                                                                                                                                                                                                                                                                                                                                                                                                                                                         |  | Metriaclima zebra; Pseudotropheus sp. 'Pseudotropheus zebra complex'; Pseudotropheus zebra; zebra mbuna; Maylandia zebra (Boulenger, 1899)                                                                                                                                                                                                                                                                                                                                                                                   |  |
| 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; Labeotropheus |  | 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; Maylandia; Maylandia zebra complex |  |
| Parent                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |  | Parent                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |  |
| Labeotropheus () - (Rank: genus)<br>( <a href="https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 57306">https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 57306</a> )                                                                                                                                                                                                                                                                                                             |  | Maylandia zebra complex () - (Rank: species group)<br>( <a href="https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 57445">https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 57445</a> )                                                                                                                                                                                                                                                                                                                |  |
| NCBI Taxonomy ID                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |  | NCBI Taxonomy ID                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |  |
| 57307<br>( <a href="https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 57307">https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 57307</a> )                                                                                                                                                                                                                                                                                                                                        |  | 106582<br>( <a href="https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 106582">https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 106582</a> )                                                                                                                                                                                                                                                                                                                                                          |  |
| is Taxon A an Intraspecies?                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |  | is Taxon B an Intraspecies?                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |  |
| No                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |  | No                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |  |

GENOTYPIC CHANGE

|                                                                                                                                                                                |  |                                                                                                                  |  |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|------------------------------------------------------------------------------------------------------------------|--|
| Generic Gene Name                                                                                                                                                              |  | UniProtKB Danio rerio                                                                                            |  |
| bmp4                                                                                                                                                                           |  | O13107 ( <a href="http://www.uniprot.org/uniprot/O13107">http://www.uniprot.org/uniprot/O13107</a> )             |  |
| Synonyms                                                                                                                                                                       |  | GenebankID or UniProtKB                                                                                          |  |
| BMP4                                                                                                                                                                           |  | U82231 ( <a href="https://www.ncbi.nlm.nih.gov/nuccore/U82231">https://www.ncbi.nlm.nih.gov/nuccore/U82231</a> ) |  |
| String                                                                                                                                                                         |  |                                                                                                                  |  |
| -                                                                                                                                                                              |  |                                                                                                                  |  |
| Sequence Similarities                                                                                                                                                          |  |                                                                                                                  |  |
| Belongs to the TGF-beta family.                                                                                                                                                |  |                                                                                                                  |  |
| GO - Molecular Function                                                                                                                                                        |  |                                                                                                                  |  |
| GO:0005125 : cytokine activity ( <a href="https://www.ebi.ac.uk/QuickGO/term/GO:0005125">https://www.ebi.ac.uk/QuickGO/term/GO:0005125</a> )                                   |  |                                                                                                                  |  |
| GO:0008083 : growth factor activity ( <a href="https://www.ebi.ac.uk/QuickGO/term/GO:0008083">https://www.ebi.ac.uk/QuickGO/term/GO:0008083</a> )                              |  |                                                                                                                  |  |
| GO:0005160 : transforming growth factor beta receptor binding<br>( <a href="https://www.ebi.ac.uk/QuickGO/term/GO:0005160">https://www.ebi.ac.uk/QuickGO/term/GO:0005160</a> ) |  |                                                                                                                  |  |
| GO - Biological Process                                                                                                                                                        |  |                                                                                                                  |  |

GO:0007507 : heart development (<https://www.ebi.ac.uk/QuickGO/term/GO:0007507>)  
GO:0035162 : embryonic hemopoiesis  
(<https://www.ebi.ac.uk/QuickGO/term/GO:0035162>)  
GO:0008284 : positive regulation of cell proliferation  
(<https://www.ebi.ac.uk/QuickGO/term/GO:0008284>)  
GO:0030509 : BMP signaling pathway  
(<https://www.ebi.ac.uk/QuickGO/term/GO:0030509>)  
GO:0048468 : cell development (<https://www.ebi.ac.uk/QuickGO/term/GO:0048468>)  
GO:0010862 : positive regulation of pathway-restricted SMAD protein phosphorylation  
(<https://www.ebi.ac.uk/QuickGO/term/GO:0010862>)  
GO:0042981 : regulation of apoptotic process  
(<https://www.ebi.ac.uk/QuickGO/term/GO:0042981>)  
GO:0043408 : regulation of MAPK cascade  
(<https://www.ebi.ac.uk/QuickGO/term/GO:0043408>)  
GO:0060395 : SMAD protein signal transduction  
(<https://www.ebi.ac.uk/QuickGO/term/GO:0060395>)  
GO:0061312 : BMP signaling pathway involved in heart development  
(<https://www.ebi.ac.uk/QuickGO/term/GO:0061312>)  
GO:0003303 : BMP signaling pathway involved in heart jogging  
(<https://www.ebi.ac.uk/QuickGO/term/GO:0003303>)  
GO:0060803 : BMP signaling pathway involved in mesodermal cell fate specification  
(<https://www.ebi.ac.uk/QuickGO/term/GO:0060803>)  
GO:0045165 : cell fate commitment (<https://www.ebi.ac.uk/QuickGO/term/GO:0045165>)  
GO:0035844 : cloaca development (<https://www.ebi.ac.uk/QuickGO/term/GO:0035844>)  
GO:0061371 : determination of heart left/right asymmetry  
(<https://www.ebi.ac.uk/QuickGO/term/GO:0061371>)  
GO:0007368 : determination of left/right symmetry  
(<https://www.ebi.ac.uk/QuickGO/term/GO:0007368>)  
GO:0071910 : determination of liver left/right asymmetry  
(<https://www.ebi.ac.uk/QuickGO/term/GO:0071910>)  
GO:0035469 : determination of pancreatic left/right asymmetry  
(<https://www.ebi.ac.uk/QuickGO/term/GO:0035469>)  
GO:0048264 : determination of ventral identity  
(<https://www.ebi.ac.uk/QuickGO/term/GO:0048264>)  
GO:0048565 : digestive tract development  
(<https://www.ebi.ac.uk/QuickGO/term/GO:0048565>)  
GO:0009953 : dorsal/ventral pattern formation  
(<https://www.ebi.ac.uk/QuickGO/term/GO:0009953>)  
GO:0035125 : embryonic anal fin morphogenesis  
(<https://www.ebi.ac.uk/QuickGO/term/GO:0035125>)  
GO:0003146 : heart jogging (<https://www.ebi.ac.uk/QuickGO/term/GO:0003146>)  
GO:0001947 : heart looping (<https://www.ebi.ac.uk/QuickGO/term/GO:0001947>)  
GO:0001707 : mesoderm formation (<https://www.ebi.ac.uk/QuickGO/term/GO:0001707>)  
GO:0042664 : negative regulation of endodermal cell fate specification  
(<https://www.ebi.ac.uk/QuickGO/term/GO:0042664>)  
GO:0060034 : notochord cell differentiation  
(<https://www.ebi.ac.uk/QuickGO/term/GO:0060034>)  
GO:0030903 : notochord development  
(<https://www.ebi.ac.uk/QuickGO/term/GO:0030903>)  
GO:0030513 : positive regulation of BMP signaling pathway  
(<https://www.ebi.ac.uk/QuickGO/term/GO:0030513>)  
GO:0003342 : proepicardium development  
(<https://www.ebi.ac.uk/QuickGO/term/GO:0003342>)  
GO:0048793 : pronephros development  
(<https://www.ebi.ac.uk/QuickGO/term/GO:0048793>)

GO - Cellular Component

GO:0005615 : extracellular space (<https://www.ebi.ac.uk/QuickGO/term/GO:0005615>)

Presumptive Null

Unknown ([https://www.gephebase.org/search-criteria?/and\\*Presumptive Null=~Unknown~#gephebase-summary-title](https://www.gephebase.org/search-criteria?/and*Presumptive Null=~Unknown~#gephebase-summary-title))

Molecular Type

Unknown ([https://www.gephebase.org/search-criteria?/and\\*Molecular Type=~Unknown~#gephebase-summary-title](https://www.gephebase.org/search-criteria?/and*Molecular Type=~Unknown~#gephebase-summary-title))

Aberration Type

Unknown ([https://www.gephebase.org/search-criteria?/and\\*Aberration Type=~Unknown~#gephebase-summary-title](https://www.gephebase.org/search-criteria?/and*Aberration Type=~Unknown~#gephebase-summary-title))

Molecular Details of the Mutation

Not identified

Experimental Evidence

Linkage Mapping ([https://www.gephebase.org/search-criteria?/and\\*Experimental Evidence=~Linkage Mapping~#gephebase-summary-title](https://www.gephebase.org/search-criteria?/and*Experimental Evidence=~Linkage Mapping~#gephebase-summary-title))

Main Reference

Integration and evolution of the cichlid mandible: the molecular basis of alternate feeding strategies. (2005) (<https://pubmed.ncbi.nlm.nih.gov/16251275>)

Authors

Albertson RC; Streelman JT; Kocher TD; Yelick PC

Abstract

African cichlid fishes have repeatedly evolved highly specialized modes of feeding through adaptations of their oral jaws. Here, we explore the molecular genetic basis of the opening and closing lever mechanisms of the cichlid lower jaw, which have traditionally been used to describe the mechanics of feeding behavior in bony fishes. Quantitative genetic analyses demonstrate that the opening and closing mechanisms are genetically modular and therefore free to evolve independently. Bmp4 (bone morphogenetic protein 4) is one of two loci that segregate with the mechanical advantage of closing and that together account for >30% of the phenotypic variance in this trait. Species-specific differences in jaw shape are obvious early in cichlid larval development and are correlated with patterns of bmp4 expression in the mandibular primordium. When bmp4 is overexpressed in the obligate suction feeder Danio rerio, mandibular morphology exhibits specific transformations of opening and closing lever ratios. We conclude that patterns of morphological integration of the cichlid jaw reflect a balance among conflicting

functional demands. Further, we demonstrate that bmp4 has the potential to alter mandibular morphology in a way that mimics adaptive variation among fish species.

Additional References

Integration and evolution of the cichlid mandible: the molecular basis of alternate feeding strategies. (2005) (<https://pubmed.ncbi.nlm.nih.gov/16251275>)  
Genetic and developmental basis of cichlid trophic diversity. (2006) (<https://pubmed.ncbi.nlm.nih.gov/16835594>)

RELATED GEPHE

Related Genes

2 (Patched1 (Ptc1), lbh (limb bud and heart homolog)) (<https://www.gephebase.org/search-criteria?/or+Taxon ID=^57307^/and+Trait=Cranio-facial morphology/or+Taxon ID=^106582^/and+Trait=Cranio-facial morphology/and+groupHaplotypes=true#gephebase-summary-title>)

Related Haplotypes

No matches found.

EXTERNAL LINKS

COMMENTS