GEPHE SUMMARY

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

GepheID
GP00000533

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

Trait State in Taxon A
Fundulus heteroclitus - Northern populations

Trait State in Taxon B
Fundulus heteroclitus - Southern populations

Ancestral State
Data not curated

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

Taxon A

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

Common Name
mummichog

Synonyms
mummichog; Atlantic killifish; killifish; Fundulus heteroclitus (Linnaeus, 1766)

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; Atherinomorphae; Cyprinodontiformes; Cyprinodontoidei; Fundulidae; Fundulus

Parent
Fundulus () - (Rank: genus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 8077)

NCBI Taxonomy ID
8078 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 8078)

is Taxon A an Infraspecies?
No

Taxon B

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

Common Name
mummichog

Synonyms
mummichog; Atlantic killifish; killifish; Fundulus heteroclitus (Linnaeus, 1766)

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; Atherinomorphae; Cyprinodontiformes; Cyprinodontoidei; Fundulidae; Fundulus

Parent
Fundulus () - (Rank: genus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 8077)

NCBI Taxonomy ID
8078 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 8078)

is Taxon B an Infraspecies?
No

GENOTYPIC CHANGE

Generic Gene Name
Idhb

Synonyms
Idhb; Ldh-B

String
-

Sequence Similarities
Belongs to the LDH/MDH superfamily. LDH family.

GO - Molecular Function
GO:0004459 : L-lactate dehydrogenase activity (https://www.ebi.ac.uk/QuickGO/term/GO:0004459)

GO - Biological Process
GO:0005975 : carbohydrate metabolic process (https://www.ebi.ac.uk/QuickGO/term/GO:0005975)
GO:0019752 : carboxylic acid metabolic process (https://www.ebi.ac.uk/QuickGO/term/GO:0019752)

UniProtKB Fundulus heteroclitus
P20373 (http://www.uniprot.org/uniprot/P20373)

GenebankID or UniProtKB
L23795 (https://www.ncbi.nlm.nih.gov/nuccore/L23795)

GO - Cellular Component

GO:0005737 : cytoplasm (https://www.ebi.ac.uk/QuickGO/term/GO:0005737)

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

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

Molecular Details of the Mutation

unknown - candidate 1 bp change in southern populatin generates mammary tumor virus glucocorticoid responsive element

Experimental Evidence

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

Main Reference

Adaptive variation in lactate dehydrogenase-B gene expression: role of a stress-responsive regulatory element. (2000) (https://pubmed.ncbi.nlm.nih.gov/10841559)

Authors

Schulte PM; Glemet HC; Fiebig AA; Powers DA

Abstract

Although changes in gene regulation may play an important role in adaptive evolution, there have been few attempts to investigate the molecular mechanisms responsible for adaptively significant variation in gene expression. Here we describe the mechanism underlying an adaptive difference in the expression of the lactate dehydrogenase-B gene (Ldh-B) between northern and southern populations of the fish Fundulus heteroclitus. Ldh-B regulatory sequences from northern and southern individuals, coupled to a luciferase reporter gene, were introduced into the livers of live fish. Deletion studies indicated that sequence changes between 400 and 500 bp upstream of the transcription start site resulted in a 2-fold difference in reporter gene transcription. These sequence changes can account for the previously observed 2-fold difference in Ldh-B transcription between populations. Variation in transcription factors did not play an important role. Sequences within the functionally important region resemble a mammary tumor virus glucocorticoid responsive element (MTV-GRE) in southern alleles, whereas northern alleles differ from the consensus by 1 bp. To test the hypothesis that this element is involved in the variation between populations of F. heteroclitus, we exposed transiently transgenic fish containing Ldh-B regulatory sequence/reporter gene constructs to handling stress or injected cortisol. Both treatments increased reporter gene transcription driven by southern alleles but not northern alleles, as expected if an MTV-GRE sequence were involved. This finding suggests that sequence variation in a GRE is the cause of the adaptive differences in Ldh-B gene expression between populations and demonstrates that small changes in gene regulatory sequences can have important evolutionary consequences.

Additional References

RELATED GEPHE

Related Genes

No matches found.

Related Haplotypes

No matches found.

EXTERNAL LINKS

COMMENTS