GEPHE SUMMARY

Gephebase Gene

Fads2 (https://www.gephebase.org/search-criteria?/and+Gene Gephebase=^Fads2^#gephebase-summary-title)

GepheID

GP00001959

Entry Status

Published

Main curator

Santos

PHENOTYPIC CHANGE

Trait Category

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

Trait

Fatty acid metabolism (fatty acid desaturation) (https://www.gephebase.org/search-criteria?/and+Trait=^Fatty acid metabolism (fatty acid desaturation)^#gephebase-summary-title)

Trait State in Taxon A

Low physiological ability to survive in freshwater DHA free diets

Trait State in Taxon B

High physiological ability to survive in freshwater DHA free diets

Ancestral State

Taxon A

Taxonomic Status

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

Taxon A

Latin Name

Gasterosteus nipponicus (https://www.gephebase.org/search-criteria?/and+Taxon and Synonyms=^Gasterosteus nipponicus^#gephebase-summary-title)

Common Name

-

Synonyms

Gasterosteus nipponicus Higuichi, Sakai & Gotu, 2014; HUMZ 97486; HUMZ:97486

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; Eupercaria; Perciformes; Cottioidei; Gasterosteales; Gasterosteidae; Gasterosteus

Parent

Gasterosteus () - (Rank: genus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 69292)

NCBI Taxonomy ID

1778380 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 1778380)

is Taxon A an Infraspecies?

No

Taxon B

Latin Name

Gasterosteus aculeatus (https://www.gephebase.org/search-criteria?/and+Taxon and Synonyms=^Gasterosteus aculeatus^#gephebase-summary-title)

Common Name

three-spined stickleback

Synonyms

three-spined stickleback; three spined stickleback; Gasterosteus aculeatus Linnaeus, 1758

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; Eupercaria; Perciformes; Cottioidei; Gasterosteales; Gasterosteidae; Gasterosteus

Parent

Gasterosteus () - (Rank: genus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 69292)

NCBI Taxonomy ID

69293 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 69293)

is Taxon B an Infraspecies?

No

GENOTYPIC CHANGE

Generic Gene Name

fads2

Synonyms

Fadsd6; DRD5/D6; wu:fb64c04; wu:fb69e08; zgc:112502; fadsd6

String

7955.ENSDARP00000022396 (http://string-db.org/newstring_cgi/show_network_section.pl?identifier=7955.ENSDARP00000022396)

Sequence Similarities

Belongs to the fatty acid desaturase type 1 family.

GO - Molecular Function

GO:0016213 : linoleoyl-CoA desaturase activity (https://www.ebi.ac.uk/QuickGO/term/GO:0016213)

GO - Biological Process

GO:0006636 : unsaturated fatty acid biosynthetic process

UniProtKB Danio rerio

Q9DEX7 (http://www.uniprot.org/uniprot/Q9DEX7)

GenebankID or UniProtKB

()

(https://www.ebi.ac.uk/QuickGO/term/GO:0006636)
GO:0001889 : liver development (https://www.ebi.ac.uk/QuickGO/term/GO:0001889)

GO - Cellular Component

GO:0016021 : integral component of membrane
(https://www.ebi.ac.uk/QuickGO/term/GO:0016021)
GO:0005789 : endoplasmic reticulum membrane
(https://www.ebi.ac.uk/QuickGO/term/GO:0005789)

Presumptive Null

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

Molecular Type

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

Aberration Type

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

Insertion Size

1-10 kb

Molecular Details of the Mutation

Fads2 locus is duplicated in G. aculeatus increasing DHA intake and the propensity to invade of freshwater environments. The ancestral copy is on linkage group 19 and the derived copy is on linkage group 12.

Experimental Evidence

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

Main Reference

A key metabolic gene for recurrent freshwater colonization and radiation in fishes. (2019) (https://pubmed.ncbi.nlm.nih.gov/31147520)

Authors

Ishikawa A; Kabeya N; Ikeya K; Kakioka R; Cech JN; Osada N; Leal MC; Inoue J; Kume M; Toyoda A; Tezuka A; Nagano AJ; Yamasaki YY; Suzuki Y; Kokita T; Takahashi H; Lucek K; Marques D; Takehana Y; Naruse K; Mori S; Monroig O; Ladd N; Schubert CJ; Matthews B; Peichel CL; Seehausen O; Yoshizaki G; Kitano J

Abstract

Colonization of new ecological niches has triggered large adaptive radiations. Although some lineages have made use of such opportunities, not all do so. The factors causing this variation among lineages are largely unknown. Here, we show that deficiency in docosahexaenoic acid (DHA), an essential Ï‰-3 fatty acid, can constrain freshwater colonization by marine fishes. Our genomic analyses revealed multiple independent duplications of the fatty acid desaturase gene Fads2 in stickleback lineages that subsequently colonized and radiated in freshwater habitats, but not in close relatives that failed to colonize. Transgenic manipulation of Fads2 in marine stickleback increased their ability to synthesize DHA and survive on DHA-deficient diets. Multiple freshwater ray-finned fishes also show a convergent increase in Fads2 copies, indicating its key role in freshwater colonization.

Additional References

RELATED GEPHE

Related Genes

No matches found.

Related Haplotypes

No matches found.

EXTERNAL LINKS

COMMENTS

@TEPossibly - Not clear whether the duplications of Fads2 in Canadian and Japanese populations are independent or not.