

GEPHE SUMMARY

Fads2 (https://www.gephebase.org/search-criteria/?and+Gene Gephebase=^Fads2^#gephebase-summary-title)	Gephebase Gene	GP00001959	Gepheid
	Entry Status	Santos	Main curator
Published			

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		Taxon B	
Gasterosteus nipponicus (https://www.gephebase.org/search-criteria/?and+Taxon and Synonyms=^Gasterosteus nipponicus^#gephebase-summary-title)	Latin Name	Gasterosteus aculeatus (https://www.gephebase.org/search-criteria/?and+Taxon and Synonyms=^Gasterosteus aculeatus^#gephebase-summary-title)	Latin Name
-	Common Name	three-spined stickleback	Common Name
Gasterosteus nipponicus Higuichi; Sakai & Gotu, 2014; HUMZ 97486; HUMZ:97486 species	Synonyms	three-spined stickleback; three spined stickleback; Gasterosteus aculeatus Linnaeus, 1758	Synonyms
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; Eucaanthomorphacea; Percomorphacea; Euperaria; Perciformes; Cottioidei; Gasterosteales; Gasterosteidae; Gasterosteus	Rank	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; Eucaanthomorphacea; Percomorphacea; Euperaria; Perciformes; Cottioidei; Gasterosteales; Gasterosteidae; Gasterosteus	Rank
Gasterosteus () - (Rank: genus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 69292)	Lineage	Gasterosteus () - (Rank: genus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 69292)	Lineage
1778380 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 1778380)	Parent	69293 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 69293)	Parent
	NCBI Taxonomy ID		NCBI Taxonomy ID
	is Taxon A an Infraspecies?		is Taxon B an Infraspecies?
No		No	

GENOTYPIC CHANGE

fads2	Generic Gene Name	UniProtKB Danio rerio
Fadsd6; DRD5/D6; wu:fb64c04; wu:fb69e08; zgc:112502; fadsd6	Synonyms	GenebankID or UniProtKB
7955.ENSDARP00000022396 (http://string-db.org/newstring_cgi/show_network_section.pl?identifier=7955.ENSDARP00000022396)	String	
Belongs to the fatty acid desaturase type 1 family.	Sequence Similarities	
GO:0016213 : linoleoyl-CoA desaturase activity (https://www.ebi.ac.uk/QuickGO/term/GO:0016213)	GO - Molecular Function	
GO:0006636 : unsaturated fatty acid biosynthetic process	GO - Biological Process	

(<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 $\omega-3$ 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.

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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.