

## GEPHE SUMMARY

### Gephebase Gene

Fads2

### Entry Status

Published

### GepheID

GP00001959

### Main curator

Santos

## PHENOTYPIC CHANGE

### Trait Category

Physiology

### Trait

Fatty acid metabolism (fatty acid desaturation)

### 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

### Taxon A

#### Latin Name

*Gasterosteus nipponicus*

#### Common Name

-

#### Synonyms

*Gasterosteus nipponicus* Higuchi, 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; Euteleostomorpha; Neoteleostei; Eurypterygia; Ctenosquamata; Acanthomorpha; Euacanthomorpha; Percormorphaceae; Eupercaria; Perciformes; Cottioidei; Gasterosteales; Gasterosteidae; Gasterosteus

#### Parent

*Gasterosteus* () - (Rank: genus)

#### NCBI Taxonomy ID

1778380

#### is Taxon A an Intraspecies?

No

### Taxon B

#### Latin Name

*Gasterosteus aculeatus*

#### 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; Euteleostomorpha; Neoteleostei; Eurypterygia; Ctenosquamata; Acanthomorpha; Euacanthomorpha; Percormorphaceae; Eupercaria; Perciformes; Cottioidei; Gasterosteales; Gasterosteidae; Gasterosteus

#### Parent

*Gasterosteus* () - (Rank: genus)

#### NCBI Taxonomy ID

69293

#### is Taxon B an Intraspecies?

No

## GENOTYPIC CHANGE

### Generic Gene Name

fads2

### Synonyms

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

### String

7955.ENSДАРP00000022396

### Sequence Similarities

Belongs to the fatty acid desaturase type 1 family.

### GO - Molecular Function

GO:0016213 : linoleoyl-CoA desaturase activity

### GO - Biological Process

GO:0006636 : unsaturated fatty acid biosynthetic process

GO:0001889 : liver development

### GO - Cellular Component

GO:0016021 : integral component of membrane

GO:0005789 : endoplasmic reticulum membrane

### UniProtKB Danio rerio

Q9DEX7

### GenebankID or UniProtKB

#### Presumptive Null

No

#### Molecular Type

Gene Amplification

#### Aberration Type

Insertion

#### 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

#### Main Reference

[A key metabolic gene for recurrent freshwater colonization and radiation in fishes. \(2019\)](#)

#### 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.