

GEPHE SUMMARY

| | | |
|---|----------------|--------------|
| | Gephebase Gene | GephelD |
| Green-sensitive opsin (RH2) (https://www.gephebase.org/search-criteria?/and+Gene Gephebase=^Green-sensitive opsin (RH2)^#gephebase-summary-title) | GP00001469 | Main curator |
| Published | Entry Status | Prigent |

PHENOTYPIC CHANGE

| | | Trait Category | |
|--|------------------|-----------------------------|--|
| Physiology (https://www.gephebase.org/search-criteria?/and+Trait Category=^Physiology^#gephebase-summary-title) | | Trait | |
| Color vision (blue shift) (https://www.gephebase.org/search-criteria?/and+Trait=^Color vision (blue shift)^#gephebase-summary-title) | | Trait State in Taxon A | |
| other teleost Percomorphaceae fishes (fugu & stickleback) | | Trait State in Taxon B | |
| Pacific bluefin tuna | | Ancestral State | |
| Taxon A | | Taxonomic Status | |
| Percomorphaceae (https://www.gephebase.org/search-criteria?/and+Taxon+and+Synonyms=^Percomorphaceae^#gephebase-summary-title) | | Latin Name | Latin Name |
| - | | Common Name | |
| - | | Synonyms | |
| no rank | | 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; Acanthomorpha; Euacanthomorphacea | | Lineage | |
| Euacanthomorphacea () - (Rank: no rank) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 123369) | | Parent | |
| 1489872 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 1489872) | NCBI Taxonomy ID | | |
| No | | is Taxon A an Infraspecies? | |
| opn1mw1 | | Generic Gene Name | UniProtKB Danio rerio |
| RH2-1; rh2.1; zfgrl1; grops1; rh21 | | Synonyms | GenebankID or UniProtKB |
| 7955.ENSDARP00000001158 (http://string-db.org/newstring_cgi/show_network_section.pl?identifier=7955.ENSDARP00000001158) | | String | AB290451 (https://www.ncbi.nlm.nih.gov/nuccore/AB290451) |
| Belongs to the G-protein coupled receptor 1 family. Opsin subfamily. | | Sequence Similarities | |
| GO:0008020 : G protein-coupled photoreceptor activity (https://www.ebi.ac.uk/QuickGO/term/GO:0008020) | | GO - Molecular Function | |
| GO:0009881 : photoreceptor activity (https://www.ebi.ac.uk/QuickGO/term/GO:0009881) | | GO - Biological Process | |

GENOTYPIC CHANGE

| | | |
|--|-------------------------|--|
| opn1mw1 | Generic Gene Name | UniProtKB Danio rerio |
| RH2-1; rh2.1; zfgrl1; grops1; rh21 | Synonyms | GenebankID or UniProtKB |
| 7955.ENSDARP00000001158 (http://string-db.org/newstring_cgi/show_network_section.pl?identifier=7955.ENSDARP00000001158) | String | AB290451 (https://www.ncbi.nlm.nih.gov/nuccore/AB290451) |
| Belongs to the G-protein coupled receptor 1 family. Opsin subfamily. | Sequence Similarities | |
| GO:0008020 : G protein-coupled photoreceptor activity (https://www.ebi.ac.uk/QuickGO/term/GO:0008020) | GO - Molecular Function | |
| GO:0009881 : photoreceptor activity (https://www.ebi.ac.uk/QuickGO/term/GO:0009881) | GO - Biological Process | |

GO:0007186 : G protein-coupled receptor signaling pathway
 (<https://www.ebi.ac.uk/QuickGO/term/GO:0007186>)
 GO:0018298 : protein-chromophore linkage
 (<https://www.ebi.ac.uk/QuickGO/term/GO:0018298>)
 GO:0007601 : visual perception (<https://www.ebi.ac.uk/QuickGO/term/GO:0007601>)
 GO:0071482 : cellular response to light stimulus
 (<https://www.ebi.ac.uk/QuickGO/term/GO:0071482>)
 GO:0007602 : phototransduction (<https://www.ebi.ac.uk/QuickGO/term/GO:0007602>)

GO - Cellular Component

GO:0005887 : integral component of plasma membrane
 (<https://www.ebi.ac.uk/QuickGO/term/GO:0005887>)
 GO:0001750 : photoreceptor outer segment
 (<https://www.ebi.ac.uk/QuickGO/term/GO:0001750>)

Presumptive Null

No ([https://www.gephebase.org/search-criteria?/and+Presumptive Null=%27No%27#gephebase-summary-title](https://www.gephebase.org/search-criteria?/and+Presumptive%20Null=%27No%27#gephebase-summary-title))

Molecular Type

Coding ([https://www.gephebase.org/search-criteria?/and+Molecular Type=%27Coding%27#gephebase-summary-title](https://www.gephebase.org/search-criteria?/and+Molecular%20Type=%27Coding%27#gephebase-summary-title))

Aberration Type

SNP ([https://www.gephebase.org/search-criteria?/and+Aberration Type=%27SNP%27#gephebase-summary-title](https://www.gephebase.org/search-criteria?/and+Aberration%20Type=%27SNP%27#gephebase-summary-title))

SNP Coding Change

Nonsynonymous

Molecular Details of the Mutation

p.E122Q (G>C) in four of five genes

Experimental Evidence

Candidate Gene ([https://www.gephebase.org/search-criteria?/and+Experimental Evidence=%27Candidate Gene%27#gephebase-summary-title](https://www.gephebase.org/search-criteria?/and+Experimental%20Evidence=%27Candidate%20Gene%27#gephebase-summary-title))

| | Taxon A | Taxon B | Position |
|------------|---------|---------|----------|
| Codon | - | - | - |
| Amino-acid | - | - | - |

Main Reference

Evolutionary changes of multiple visual pigment genes in the complete genome of Pacific bluefin tuna. (2013) (<https://pubmed.ncbi.nlm.nih.gov/23781100/>)

Authors

Nakamura Y; Mori K; Saitoh K; Oshima K; Mekuchi M; Sugaya T; Shigenobu Y; Ojima N; Muta S; Fujiwara A; Yasuike M; Oohara I; Hirakawa H; Chowdhury VS; Kobayashi T; Nakajima K; Sano M; Wada T; Tashiro K; Ikeo K; Hattori M; Kuhara S; Gojobori T; Inouye K

Abstract

Tunas are migratory fishes in offshore habitats and top predators with unique features. Despite their ecological importance and high market values, the open-ocean lifestyle of tuna, in which effective sensing systems such as color vision are required for capture of prey, has been poorly understood. To elucidate the genetic and evolutionary basis of optic adaptation of tuna, we determined the genome sequence of the Pacific bluefin tuna (*Thunnus orientalis*), using next-generation sequencing technology. A total of 26,433 protein-coding genes were predicted from 16,802 assembled scaffolds. From these, we identified five common fish visual pigment genes: red-sensitive (middle/long-wavelength sensitive; M/LWS), UV-sensitive (short-wavelength sensitive 1; SWS1), blue-sensitive (SWS2), rhodopsin (RH1), and green-sensitive (RH2) opsin genes. Sequence comparison revealed that tuna's RH1 gene has an amino acid substitution that causes a short-wave shift in the absorption spectrum (i.e., blue shift). Pacific bluefin tuna has at least five RH2 paralogs, the most among studied fishes; four of the proteins encoded may be tuned to blue light at the amino acid level. Moreover, phylogenetic analysis suggested that gene conversions have occurred in each of the SWS2 and RH2 loci in a short period. Thus, Pacific bluefin tuna has undergone evolutionary changes in three genes (RH1, RH2, and SWS2), which may have contributed to detecting blue-green contrast and measuring the distance to prey in the blue-pelagic ocean. These findings provide basic information on behavioral traits of predatory fish and, thereby, could help to improve the technology to culture such fish in captivity for resource management.

Additional References

RELATED GEPHE

Related Genes

7 (Rhodopsin (RH1), opsin - (SWS1), opsin - (SWS2), opsin - (SWS2B), Rx1, opsin - rhodopsin (LWS), opsin - rhodopsin1 (RH1)) (<https://www.gephebase.org/search-criteria?/or+TaxonID=%271489872%27/and+Trait=Color%20vision/or+TaxonID=%278238%27/and+Trait=Color%20vision/and+groupHaplotypes=true#gephebase-summary-title>)

Related Haplotypes

No matches found.

EXTERNAL LINKS

COMMENTS

by gene duplication and conversion there are 5 RH2 genes in tuna and four of which have the same substitution

