

GEPHE SUMMARY

Rhodopsin (RH1) (https://www.gephebase.org/search-criteria?/and+GeneGephebase=~Rhodopsin (RH1)^#gephebase-summary-title)		Gephebase Gene	GP00001468	GepheID
Published		Entry Status	Prigent	Main curator

PHENOTYPIC CHANGE

Physiology (https://www.gephebase.org/search-criteria?/and+TraitCategory=~Physiology^#gephebase-summary-title)		Trait Category	
Color vision (blue shift) (https://www.gephebase.org/search-criteria?/and+Trait=~Color vision (blue shift)^#gephebase-summary-title)		Trait	
other teleost Percomorphaceae fishes (fugu & stickleback & medaka)		Trait State in Taxon A	
Pacific bluefin tuna		Trait State in Taxon B	
Taxon A		Ancestral State	
Intergeneric or Higher (https://www.gephebase.org/search-criteria?/and+TaxonomicStatus=~Intergeneric or Higher^#gephebase-summary-title)		Taxonomic Status	
Taxon A		Taxon B	
Percomorphaceae (https://www.gephebase.org/search-criteria?/and+Taxon and Synonyms=~Percomorphaceae^#gephebase-summary-title)		Thunnus orientalis (https://www.gephebase.org/search-criteria?/and+Taxon and Synonyms=~Thunnus orientalis^#gephebase-summary-title)	
-		Pacific bluefin tuna	
-		Thunnus orientalis orientalis; Thunnus thynnus orientalis; Pacific bluefin tuna; North Pacific bluefin tuna; northern bluefin tuna; Thunnus orientalis (Temminck & Schlegel, 1844)	
no rank		species	
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		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; Percomorphaceae; Pelagiaria; Scombriformes; Scombridae; Scombrinae; Thunnini; Thunnus	
Euacanthomorphacea () - (Rank: no rank) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 123369)		Thunnus () - (Rank: genus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 8234)	
1489872 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 1489872)		8238 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 8238)	
No		No	

GENOTYPIC CHANGE

rho		Generic Gene Name		UniProtKB Danio rerio
Rh; RH1; zfo2; rh1.1; zfrho; wu:fi06d11		Synonyms		GenebankID or UniProtKB
7955.ENSADARP00000011562 (http://string-db.org/newstring.cgi/show_network_section.pl?identifier=7955.ENSADARP00000011562)		String		AB290449 (https://www.ncbi.nlm.nih.gov/nuccore/AB290449)
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:0005502 : 11-cis retinal binding (https://www.ebi.ac.uk/QuickGO/term/GO:0005502)				

GO:0016918 : retinal binding (<https://www.ebi.ac.uk/QuickGO/term/GO:0016918>)
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:0016038 : absorption of visible light
(<https://www.ebi.ac.uk/QuickGO/term/GO:0016038>)
GO:0016056 : rhodopsin mediated signaling pathway
(<https://www.ebi.ac.uk/QuickGO/term/GO:0016056>)
GO:0009583 : detection of light stimulus
(<https://www.ebi.ac.uk/QuickGO/term/GO:0009583>)

GO - Cellular Component

GO:0016021 : integral component of membrane
(<https://www.ebi.ac.uk/QuickGO/term/GO:0016021>)
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>)
GO:0097381 : photoreceptor disc membrane
(<https://www.ebi.ac.uk/QuickGO/term/GO:0097381>)

Presumptive Null

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

Molecular Type

Coding (<https://www.gephebase.org/search-criteria?/and+Molecular Type=~Coding~#gephebase-summary-title>)

Aberration Type

SNP (<https://www.gephebase.org/search-criteria?/and+Aberration Type=~SNP~#gephebase-summary-title>)

SNP Coding Change

Nonsynonymous

Molecular Details of the Mutation

p.E122Q (G>C)

Experimental Evidence

Candidate Gene (<https://www.gephebase.org/search-criteria?/and+Experimental Evidence=~Candidate Gene~#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 (Green-sensitive opsin (RH2), opsin - (SWS1), opsin - (SWS2), opsin - (SWS2B), Rx1, opsin - rhodopsin (LWS), opsin - rhodopsin1 (RH1)) (<https://www.gephebase.org/search-criteria?/or+Taxon ID=~1489872~/and+Trait=Color vision/or+Taxon ID=~8238~/and+Trait=Color vision/and+groupHaplotypes=true#gephebase-summary-title>)

Related Haplotypes

No matches found.

EXTERNAL LINKS

COMMENTS

Effect of the mutation demonstrated in a previous study in coelacanth