

GEPHE SUMMARY

	Gephebase Gene		GepheID
AFGP multigene - antifreeze glycoproteins (<a +afgp+multigene+-antifreeze+glycoproteins+"#gephebase-summary-title"="" href="https://www.gephebase.org/search-criteria?/and+Gene+Gephebase=">https://www.gephebase.org/search-criteria?/and+Gene+Gephebase="+AFGP+multigene+-antifreeze+glycoproteins+"#gephebase-summary-title)		GP00000052	Main curator
	Entry Status	Martin	
Published			

PHENOTYPIC CHANGE

	Trait Category		
Physiology (<a +physiology+"#gephebase-summary-title"="" href="https://www.gephebase.org/search-criteria?/and+Trait+Category=">https://www.gephebase.org/search-criteria?/and+Trait+Category="+Physiology+"#gephebase-summary-title)			
	Trait		
Anti-freezing (<a +anti-freezing+"#gephebase-summary-title"="" href="https://www.gephebase.org/search-criteria?/and+Trait=">https://www.gephebase.org/search-criteria?/and+Trait="+Anti-freezing+"#gephebase-summary-title)			
	Trait State in Taxon A		
Other fishes			
	Trait State in Taxon B		
Dissostichus mawsoni - notothenioid fishes			
	Ancestral State		
Data not curated			
	Taxonomic Status		
Intergeneric or Higher (<a +intergeneric+or+higher+"#gephebase-summary-title"="" href="https://www.gephebase.org/search-criteria?/and+Taxonomic+Status=">https://www.gephebase.org/search-criteria?/and+Taxonomic+Status="+Intergeneric+or+Higher+"#gephebase-summary-title)			
Taxon A		Taxon B	
	Latin Name		Latin Name
Teleostei (<a +teleostei+"#gephebase-summary-title"="" href="https://www.gephebase.org/search-criteria?/and+Taxon+and+Synonyms=">https://www.gephebase.org/search-criteria?/and+Taxon+and+Synonyms="+Teleostei+"#gephebase-summary-title)		Dissostichus mawsoni (<a +dissostichus+mawsoni+"#gephebase-summary-title"="" href="https://www.gephebase.org/search-criteria?/and+Taxon+and+Synonyms=">https://www.gephebase.org/search-criteria?/and+Taxon+and+Synonyms="+Dissostichus+mawsoni+"#gephebase-summary-title)	
	Common Name		Common Name
teleost fishes		Antarctic toothfish	
	Synonyms		Synonyms
teleost fishes		Antarctic toothfish; Dissostichus mawsoni Norman, 1937; Dissostichus mawsonii; Dissosticus mawsoni	
	Rank		Rank
infraclass		species	
	Lineage		Lineage
cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Deuterostomia; Chordata; Craniata; Vertebrata; Gnathostomata; Teleostomi; Euteleostomi; Actinopterygii; Actinopteri; Neopterygii		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; Percormorphacea; Eupercaria; Perciformes; Notothenioidei; Nototheniidae; Dissostichus	
	Parent		Parent
Neopterygii () - (Rank: subclass) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=41665)		Dissostichus () - (Rank: genus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=36199)	
	NCBI Taxonomy ID		NCBI Taxonomy ID
32443 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=32443)		36200 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=36200)	
	is Taxon A an Intraspecies?		is Taxon B an Intraspecies?
No		No	

GENOTYPIC CHANGE

	Generic Gene Name		UniProtKB Notothenia neglecta
afgp8		P24856 (http://www.uniprot.org/uniprot/P24856)	GenebankID or UniProtKB
	Synonyms		
-		0	
	String		
-			
	Sequence Similarities		
-			
	GO - Molecular Function		
-			
	GO - Biological Process		
-			
	GO - Cellular Component		
GO:0005576 : extracellular region (https://www.ebi.ac.uk/QuickGO/term/GO:0005576)			

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

Presumptive Null

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

Molecular Type

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

Aberration Type

multiple modifications of a pancreatic; secreted trypsinogen; notably via multiplications of small tri-peptidic repeats

Molecular Details of the Mutation

Candidate Gene (<https://www.gephebase.org/search-criteria?/and+Experimental+Evidence=~Candidate+Gene^#gephebase-summary-title>)

Experimental Evidence

Evolution of antifreeze glycoprotein gene from a trypsinogen gene in Antarctic notothenioid fish. (1997) (<https://pubmed.ncbi.nlm.nih.gov/9108060>)

Main Reference

Chen L; DeVries AL; Cheng CH

Authors

Freezing avoidance conferred by different types of antifreeze proteins in various polar and subpolar fishes represents a remarkable example of cold adaptation, but how these unique proteins arose is unknown. We have found that the antifreeze glycoproteins (AFGPs) of the predominant Antarctic fish taxon, the notothenioids, evolved from a pancreatic trypsinogen. We have determined the likely evolutionary process by which this occurred through characterization and analyses of notothenioid AFGP and trypsinogen genes. The primordial AFGP gene apparently arose through recruitment of the 5' and 3' ends of an ancestral trypsinogen gene, which provided the secretory signal and the 3' untranslated region, respectively, plus de novo amplification of a 9-nt Thr-Ala-Ala coding element from the trypsinogen progenitor to create a new protein coding region for the repetitive tripeptide backbone of the antifreeze protein. The small sequence divergence (4-7%) between notothenioid AFGP and trypsinogen genes indicates that the transformation of the proteinase gene into the novel ice-binding protein gene occurred quite recently, about 5-14 million years ago (mya), which is highly consistent with the estimated times of the freezing of the Antarctic Ocean at 10-14 mya, and of the main phyletic divergence of the AFGP-bearing notothenioid families at 7-15 mya. The notothenioid trypsinogen to AFGP conversion is the first clear example of how an old protein gene spawned a new gene for an entirely new protein with a new function. It also represents a rare instance in which protein evolution, organismal adaptation, and environmental conditions can be linked directly.

Abstract

Nonhepatic origin of notothenioid antifreeze reveals pancreatic synthesis as common mechanism in polar fish freezing avoidance. (2006) (<https://pubmed.ncbi.nlm.nih.gov/16798878>)
Ancient climate change, antifreeze, and the evolutionary diversification of Antarctic fishes. (2012) (<https://pubmed.ncbi.nlm.nih.gov/22331888>)

Additional References

RELATED GEPHE

1 (PEPT1) (<https://www.gephebase.org/search-criteria?/or+Taxon+ID=~32443^/and+Trait=Anti-freezing/or+Taxon+ID=~36200^/and+Trait=Anti-freezing/and+groupHaplotypes=true#gephebase-summary-title>)

Related Genes

No matches found.

Related Haplotypes

EXTERNAL LINKS

COMMENTS