

GEPHE SUMMARY

	Gephebase Gene	GephelD
AFGP multigene - antifreeze glycoproteins (#gephebase-summary-title)	GP00000052	Main curator
	Entry Status	
Published		

PHENOTYPIC CHANGE

	Trait Category	
Physiology (<a and+trait="^Anti-freezing^#gephebase-summary-title)</a" href="https://www.gephebase.org/search-criteria?/and+Trait Category=^Physiology^#gephebase-summary-title)</td><td>Trait</td><td></td></tr> <tr> <td>Anti-freezing (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 and="" and+taxon="" href="https://www.gephebase.org/search-criteria?/and+Taxonomic Status=^Intergeneric or Higher^#gephebase-summary-title)</td><td></td><td></td></tr> <tr> <th>Taxon A</th><th></th><th>Taxon B</th></tr> <tr> <td>Teleostei
(<a href=" https:="" search-criteria?="" synonyms="^Teleostei^#gephebase-summary-title)</a" www.gephebase.org="">)	Latin Name	Latin Name
teleost fishes	Common Name	Common Name
teleost fishes	Synonyms	Synonyms
infraclass	Rank	Rank
cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Deuterostomia; Chordata; Craniata; Vertebrata; Gnathostomata; Teleostomi; Euteleostomi; Actinopterygii; Actinopteri; Neopterygii	Lineage	Lineage
Neopterygii () - (Rank: subclass) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 41665)	Parent	Parent
32443 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 32443)	NCBI Taxonomy ID	NCBI Taxonomy ID
No	is Taxon A an Infraspecies?	is Taxon B an Infraspecies?

GENOTYPIC CHANGE

afgp8	Generic Gene Name	UniProtKB Notothenia neglecta
-	Synonyms	GenebankID or UniProtKB
-	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 (#gephebase-summary-title)	Presumptive Null
Coding (#gephebase-summary-title)	Molecular 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 (#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
Abstract	
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.	Additional References
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)	

RELATED GEPHE

1 (PEPT1) (#gephebase-summary-title)	Related Genes
No matches found.	Related Haplotypes

EXTERNAL LINKS

COMMENTS