

## GEPHE SUMMARY

<p>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</a>)</p> <p>Published</p>	<p>Gephebase Gene</p> <p>Entry Status</p>	<p>GP00000052</p> <p>Martin</p>	<p>GepheID</p> <p>Main curator</p>
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## PHENOTYPIC CHANGE

<p>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</a>)</p> <p>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</a>)</p> <p>Other fishes</p> <p>Dissostichus mawsoni - notothenioid fishes</p> <p>Data not curated</p> <p>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</a>)</p>	<p>Trait Category</p> <p>Trait</p> <p>Trait State in Taxon A</p> <p>Trait State in Taxon B</p> <p>Ancestral State</p> <p>Taxonomic Status</p>	<p>Taxon A</p> <p>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</a>)</p> <p>teleost fishes</p> <p>teleost fishes</p> <p>infraclass</p> <p>cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Deuterostomia; Chordata; Craniata; Vertebrata; Gnathostomata; Teleostomi; Euteleostomi; Actinopterygii; Actinopteri; Neopterygii</p> <p>Neopterygii () - (Rank: subclass) (<a href="https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=41665">https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=41665</a>)</p> <p>32443 (<a href="https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=32443">https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=32443</a>)</p> <p>No is Taxon A an Intraspecies?</p>	<p>Latin Name</p> <p>Common Name</p> <p>Synonyms</p> <p>Rank</p> <p>Lineage</p> <p>Parent</p> <p>NCBI Taxonomy ID</p>	<p>Taxon B</p> <p>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</a>)</p> <p>Antarctic toothfish</p> <p>Antarctic toothfish; Dissostichus mawsoni Norman, 1937; Dissostichus mawsonii; Dissosticus mawsoni</p> <p>species</p> <p>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</p> <p>Dissostichus () - (Rank: genus) (<a href="https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=36199">https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=36199</a>)</p> <p>36200 (<a href="https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=36200">https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=36200</a>)</p> <p>No is Taxon B an Intraspecies?</p>	<p>Latin Name</p> <p>Common Name</p> <p>Synonyms</p> <p>Rank</p> <p>Lineage</p> <p>Parent</p> <p>NCBI Taxonomy ID</p>
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## GENOTYPIC CHANGE

<p>afgp8</p> <p>-</p> <p>-</p> <p>-</p> <p>-</p> <p>-</p> <p>GO:0005576 : extracellular region (<a href="https://www.ebi.ac.uk/QuickGO/term/GO:0005576">https://www.ebi.ac.uk/QuickGO/term/GO:0005576</a>)</p>	<p>Generic Gene Name</p> <p>Synonyms</p> <p>String</p> <p>Sequence Similarities</p> <p>GO - Molecular Function</p> <p>GO - Biological Process</p> <p>GO - Cellular Component</p>	<p>UniProtKB Notothenia neglecta</p> <p>P24856 (<a href="http://www.uniprot.org/uniprot/P24856">http://www.uniprot.org/uniprot/P24856</a>)</p> <p>0</p>	<p>GenebankID or UniProtKB</p>
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No ([https://www.gephebase.org/search-criteria?/and+Presumptive Null=~No^#gephebase-summary-title](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](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](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](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](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