

## GEPHE SUMMARY

PEPT1 ( <a href="https://www.gephebase.org/search-criteria?/and+Gene+Gephebase+PEPT1+Gephebase-summary-title">https://www.gephebase.org/search-criteria?/and+Gene+Gephebase+PEPT1+Gephebase-summary-title</a> )	Gephebase Gene	GP00000858	GepheID
Published	Entry Status	Martin	Main curator

## PHENOTYPIC CHANGE

Physiology ( <a href="https://www.gephebase.org/search-criteria?/and+Trait+Category+Physiology+Gephebase-summary-title">https://www.gephebase.org/search-criteria?/and+Trait+Category+Physiology+Gephebase-summary-title</a> )	Trait Category		
Anti-freezing ( <a href="https://www.gephebase.org/search-criteria?/and+Trait+Anti-freezing+Gephebase-summary-title">https://www.gephebase.org/search-criteria?/and+Trait+Anti-freezing+Gephebase-summary-title</a> )	Trait		
Other fishes	Trait State in Taxon A		
Chionodraco hamatus	Trait State in Taxon B		
Data not curated	Ancestral State		
Intergeneric or Higher ( <a href="https://www.gephebase.org/search-criteria?/and+Taxonomic+Status+Intergeneric+or+Higher+Gephebase-summary-title">https://www.gephebase.org/search-criteria?/and+Taxonomic+Status+Intergeneric+or+Higher+Gephebase-summary-title</a> )	Taxonomic Status		
	Taxon A		Taxon B
Teleostei ( <a href="https://www.gephebase.org/search-criteria?/and+Taxon+Synonyms+Teleostei+Gephebase-summary-title">https://www.gephebase.org/search-criteria?/and+Taxon+Synonyms+Teleostei+Gephebase-summary-title</a> )	Latin Name	Chionodraco hamatus ( <a href="https://www.gephebase.org/search-criteria?/and+Taxon+Synonyms+Chionodraco+hamatus+Gephebase-summary-title">https://www.gephebase.org/search-criteria?/and+Taxon+Synonyms+Chionodraco+hamatus+Gephebase-summary-title</a> )	Latin Name
teleost fishes	Common Name	Antarctic icefish	Common Name
teleost fishes	Synonyms	Chaenichthys rhinocerus hamatus; Antarctic icefish; Chaenichthys rhinocerus hamatus Lonnberg, 1905; Chionodraco hamatus (Lonnberg, 1905)	Synonyms
infraclass	Rank	species	Rank
cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Deuterostomia; Chordata; Craniata; Vertebrata; Gnathostomata; Teleostomi; Euteleostomi; Actinopterygii; Actinopteri; Neopterygii	Lineage	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; Euacanthomorpha; Percormorphacea; Eupercaria; Perciformes; Notothenioidei; Channichthyidae; Chionodraco	Lineage
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> )	Parent	Chionodraco () - (Rank: genus) ( <a href="https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=34788">https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=34788</a> )	Parent
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> )	NCBI Taxonomy ID	36188 ( <a href="https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=36188">https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=36188</a> )	NCBI Taxonomy ID
No	is Taxon A an Intraspecies?	No	is Taxon B an Intraspecies?

## GENOTYPIC CHANGE

slc15a1	Generic Gene Name	Q804I3 ( <a href="http://www.uniprot.org/uniprot/Q804I3">http://www.uniprot.org/uniprot/Q804I3</a> )	UniProtKB Chionodraco hamatus
-	Synonyms	AY170828 ( <a href="https://www.ncbi.nlm.nih.gov/nucleotide/AY170828">https://www.ncbi.nlm.nih.gov/nucleotide/AY170828</a> )	GenebankID or UniProtKB
-	String		
Belongs to the PTR2/POT transporter (TC 2.A.17) family.	Sequence Similarities		
GO:0022857 : transmembrane transporter activity ( <a href="https://www.ebi.ac.uk/QuickGO/term/GO:0022857">https://www.ebi.ac.uk/QuickGO/term/GO:0022857</a> )	GO - Molecular Function		
GO:0006857 : oligopeptide transport ( <a href="https://www.ebi.ac.uk/QuickGO/term/GO:0006857">https://www.ebi.ac.uk/QuickGO/term/GO:0006857</a> )	GO - Biological Process		
	GO - Cellular Component		

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

Presumptive Null

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))

Molecular Type

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))

Aberration 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))

Molecular Details of the Mutation

C-terminal (cytosolic) de novo VDMSRKS domain conferring cold resistance

Experimental Evidence

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))

Main Reference

Protein cold adaptation strategy via a unique seven-amino acid domain in the icefish (*Chionodraco hamatus*) PEPT1 transporter. (2013) (<https://pubmed.ncbi.nlm.nih.gov/23569229>)

Authors

Rizzello A; Romano A; Kottra G; Acierno R; Storelli C; Verri T; Daniel H; Maffia M

Abstract

Adaptation of organisms to extreme environments requires proteins to work at thermodynamically unfavorable conditions. To adapt to subzero temperatures, proteins increase the flexibility of parts of, or even the whole, 3D structure to compensate for the lower thermal kinetic energy available at low temperatures. This may be achieved through single-site amino acid substitutions in regions of the protein that undergo large movements during the catalytic cycle, such as in enzymes or transporter proteins. Other strategies of cold adaptation involving changes in the primary amino acid sequence have not been documented yet. In Antarctic icefish (*Chionodraco hamatus*) peptide transporter 1 (PEPT1), the first transporter cloned from a vertebrate living at subzero temperatures, we came upon a unique principle of cold adaptation. A de novo domain composed of one to six repeats of seven amino acids (VDMSRKS), placed as an extra stretch in the cytosolic COOH-terminal region, contributed per se to cold adaptation. VDMSRKS was in a protein region uninvolved in transport activity and, notably, when transferred to the COOH terminus of a warm-adapted (rabbit) PEPT1, it conferred cold adaptation to the receiving protein. Overall, we provide a paradigm for protein cold adaptation that relies on insertion of a unique domain that confers greater affinity and maximal transport rates at low temperatures. Due to its ability to transfer a thermal trait, the VDMSRKS domain represents a useful tool for future cell biology or biotechnological applications.

Additional References

## RELATED GEPHE

Related Genes

1 (AFGP multigene - antifreeze glycoproteins) ([https://www.gephebase.org/search-criteria?/or+Taxon ID=^32443^/and+Trait=Anti-freezing/or+Taxon ID=^36188^/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=^36188^/and+Trait=Anti-freezing/and+groupHaplotypes=true#gephebase-summary-title))

Related Haplotypes

No matches found.

## EXTERNAL LINKS

## COMMENTS