

GEPHE SUMMARY

	Gephebase Gene		GepheID
pepsinogen A2 (https://www.gephebase.org/search-criteria?/and+Gene+Gephebase=^pepsinogen+A2^#gephebase-summary-title)		GP00001918	
Published	Entry Status	Courtier	Main curator

PHENOTYPIC CHANGE

	Trait Category
Physiology (https://www.gephebase.org/search-criteria?/and+Trait+Category=^Physiology^#gephebase-summary-title)	
	Trait
Digestion (absence of stomach) (https://www.gephebase.org/search-criteria?/and+Trait=^Digestion+absence+of+stomach^#gephebase-summary-title)	
	Trait State in Taxon A
presence of stomach and gastric acid production	
	Trait State in Taxon B
loss of stomach and no gastric acid production	
	Ancestral State
Taxon A	
	Taxonomic Status
Intergeneric or Higher (https://www.gephebase.org/search-criteria?/and+Taxonomic+Status=^Intergeneric+or+Higher^#gephebase-summary-title)	

Taxon A #1	Latin Name
Gadus morhua (https://www.gephebase.org/search-criteria?/and+Taxon+and+Synonyms=^Gadus+morhua^#gephebase-summary-title)	
	Common Name
Atlantic cod	
	Synonyms
Atlantic cod; Gadus morhua Linnaeus, 1758	
	Rank
species	
	Lineage
cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Deuterostomia; Chordata; Craniata; Vertebrata; Gnathostomata; Teleostomi; Euteleostomi; Actinopterygii; Actinopteri; Neopterygii; Teleostei; Osteoglossocephalai; Clupecocephala; Euteleostomorpha; Neoteleostei; Eurypterygia; Ctenosquamata; Acanthomorphata; Paracanthomorphacea; Zeiogadaria; Gadariae; Gadiformes; Gadoidei; Gadidae; Gadus	
	Parent
Gadus () - (Rank: genus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=8048)	
	NCBI Taxonomy ID
8049 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=8049)	
	is Taxon A an Intraspecies?
No	

Taxon B	Latin Name
Danio rerio (https://www.gephebase.org/search-criteria?/and+Taxon+and+Synonyms=^Danio+rerio^#gephebase-summary-title)	
	Common Name
zebrafish	
	Synonyms
Brachydanio rerio; Brachydanio rerio frankei; Cyprinus rerio; Danio frankei; Danio rerio frankei; zebrafish; leopard danio; zebra danio; zebra fish; Cyprinus rerio Hamilton, 1822; Danio rerio (Hamilton, 1822); Brachidanio rerio	
	Rank
species	
	Lineage
cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Deuterostomia; Chordata; Craniata; Vertebrata; Gnathostomata; Teleostomi; Euteleostomi; Actinopterygii; Actinopteri; Neopterygii; Teleostei; Osteoglossocephalai; Clupecocephala; Otomorpha; Ostariophysii; Otophysi; Cypriniphysae; Cypriniformes; Cyprinoidei; Cyprinidae; Danio	
	Parent
Danio () - (Rank: genus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=7954)	
	NCBI Taxonomy ID
7955 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=7955)	
	is Taxon B an Intraspecies?
No	

Taxon A #2	Latin Name
Gasterosteus aculeatus (https://www.gephebase.org/search-criteria?/and+Taxon+and+Synonyms=^Gasterosteus+aculeatus^#gephebase-summary-title)	
	Common Name
three-spined stickleback	
	Synonyms
three-spined stickleback; three spined stickleback; Gasterosteus aculeatus Linnaeus, 1758	
	Rank
species	
	Lineage
cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Deuterostomia; Chordata; Craniata; Vertebrata; Gnathostomata; Teleostomi; Euteleostomi; Actinopterygii; Actinopteri; Neopterygii; Teleostei; Osteoglossocephalai; Clupecocephala; Euteleostomorpha; Neoteleostei; Eurypterygia; Ctenosquamata; Acanthomorphata; Euacanthomorphacea; Percomorphaeae; Eupercaria; Perciformes; Cottioidi; Gasterosteales;	

Gasterosteidae; Gasterosteus

Parent

Gasterosteus () - (Rank: genus)

(<https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=69292>)

NCBI Taxonomy ID

69293

(<https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=69293>)

is Taxon A an Intraspecies?

No

Taxon A #3

Latin Name

Oreochromis niloticus

(<https://www.gephebase.org/search-criteria?/and+Taxon and>

Synonyms=[^]Oreochromis niloticus[^]#gephebase-summary-title)

Common Name

Nile tilapia

Synonyms

Oreochromis nilotica; Tilapia nilotica; Nile tilapia; Oreochromis niloticus (Linnaeus, 1758)

Rank

species

Lineage

cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Deuterostomia; Chordata; Craniata; Vertebrata; Gnathostomata; Teleostomi; Euteleostomi; Actinopterygii; Actinopteri; Neopterygii; Teleostei; Osteoglossocephalai; Clupecocephala; Euteleostomorpha; Neoteleostei; Eurypterygia; Ctenosquamata; Acanthomorphata; Euacanthomorphacea; Percormorphaceae; Ovalentaria; Cichlomorphae; Cichliformes; Cichlidae; African cichlids; Pseudocrenilabrinae; Oreochromini; Oreochromis

Parent

Oreochromis () - (Rank: genus)

(<https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=8139>)

NCBI Taxonomy ID

8128

(<https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=8128>)

is Taxon A an Intraspecies?

No

GENOTYPIC CHANGE

PGA4

Generic Gene Name

P0DJD7 (<http://www.uniprot.org/uniprot/P0DJD7>)

UniProtKB Homo sapiens

Synonyms

GenebankID or UniProtKB

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String

9606.ENSPO0000367391

(http://string-db.org/newstring.cgi/show_network_section.pl?identifier=9606.ENSPO0000367391)

Sequence Similarities

Belongs to the peptidase A1 family.

GO - Molecular Function

GO:0004190 : aspartic-type endopeptidase activity

(<https://www.ebi.ac.uk/QuickGO/term/GO:0004190>)

GO - Biological Process

GO:0006508 : proteolysis (<https://www.ebi.ac.uk/QuickGO/term/GO:0006508>)

GO:0044267 : cellular protein metabolic process

(<https://www.ebi.ac.uk/QuickGO/term/GO:0044267>)

GO:0007586 : digestion (<https://www.ebi.ac.uk/QuickGO/term/GO:0007586>)

GO:0030163 : protein catabolic process

(<https://www.ebi.ac.uk/QuickGO/term/GO:0030163>)

GO - Cellular Component

GO:0070062 : extracellular exosome (<https://www.ebi.ac.uk/QuickGO/term/GO:0070062>)

GO:0097486 : multivesicular body lumen

(<https://www.ebi.ac.uk/QuickGO/term/GO:0097486>)

Presumptive Null

Yes (<https://www.gephebase.org/search-criteria?/and+Presumptive Null=[^]Yes[^]#gephebase-summary-title>)

Molecular Type

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

Aberration Type

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

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Molecular Details of the Mutation

Absence of the gene in the genome sequence - high synteny

Experimental Evidence

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

Main Reference

Recurrent gene loss correlates with the evolution of stomach phenotypes in gnathostome history. (2014) (<https://pubmed.ncbi.nlm.nih.gov/24307675>)

Authors

Castro LF; Gonsalves O; Mazan S; Tay BH; Venkatesh B; Wilson JM

Abstract

The stomach, a hallmark of gnathostome evolution, represents a unique anatomical innovation characterized by the presence of acid- and pepsin-secreting glands. However, the occurrence of these glands in gnathostome species is not universal; in the nineteenth century the French zoologist Cuvier first noted that some teleosts lacked a stomach. Strikingly, Holocephali (chimaeras), dipnoids (lungfish) and monotremes (egg-laying mammals) also lack acid secretion and a gastric cellular phenotype. Here, we test the hypothesis that loss of the gastric phenotype is correlated with the loss of key gastric genes. We investigated species from all the main gnathostome lineages and show the specific contribution of gene loss to the widespread distribution of the agastric condition. We establish that the stomach loss correlates with the persistent and complete absence of the gastric function gene *kit-H(+)/K(+)-ATPase* (Atp4A and Atp4B) and pepsinogens (Pga, Pgc, Cym)--in the analysed species. We also find that in gastric species the pepsinogen gene complement varies significantly (e.g. two to four in teleosts and tens in some mammals) with multiple events of pseudogenization identified in various lineages. We propose that relaxation of purifying selection in pepsinogen genes and possibly proton pump genes in response to dietary changes led to the numerous independent events of stomach loss in gnathostome history. Significantly, the absence of the gastric genes predicts that reinvention of the stomach in agastric lineages would be highly improbable, in line with Dollo's principle.

Additional References

RELATED GEPHE

Related Genes

4 (ATP4A, ATP4B, pepsinogen A1, pepsinogen A3) (<https://www.gephebase.org/search-criteria?/or+Taxon+ID=^8049^/and+Trait=Digestion/or+Taxon+ID=^69293^/and+Trait=Digestion/or+Taxon+ID=^8128^/and+Trait=Digestion/or+Taxon+ID=^7955^/and+Trait=Digestion/and+groupHaplotypes=true#gephebase-summary-title>)

Related Haplotypes

No matches found.

EXTERNAL LINKS

COMMENTS

There are three pepsinogen A genes in teleost fishes - their nomenclature and phylogenetic relationships are different from Mammals pepsinogen genes