

GEPHE SUMMARY

	Gephebase Gene	GepheID
pepsinogen A2 (https://www.gephebase.org/search-criteria/?and+Gene Gephebase=^pepsinogen A2^#gephebase-summary-title)	GP00001931	
Published	Entry Status	Main curator

PHENOTYPIC CHANGE

	Trait Category	Trait
Physiology (https://www.gephebase.org/search-criteria/?and+Trait Category=^Physiology^#gephebase-summary-title)		
Digestion (absence of stomach) (https://www.gephebase.org/search-criteria/?and+Trait 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	
Oreochromis niloticus			
(https://www.gephebase.org/search-criteria/?and+Taxon+and+Synonyms=^Oreochromis+niloticus^#gephebase-summary-title)			
Nile tilapia		Common Name	
Oreochromis nilotica; Tilapia nilotica; Nile tilapia; Oreochromis niloticus (Linnaeus, 1758)		Synonyms	
species		Rank	
cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Deuterostomia; Chordata; Craniata; Vertebrata; Gnathostomata; Teleostomi; Euteleostomi; Actinopterygii; Actinopteri; Neopterygii; Teleostei; Osteoglossocephalai; Clupeocephala; Euteleosteomorpha; Neoteleostei; Eurypterygia; Ctenosquamata; Acanthomorphata; Euacanthomorphacea; Percomorphaceae; Ovalentaria; Cichlomorphae; Cichliformes; Cichlidae; African cichlids; Pseudocrenilabrinae; Oreochromini; Oreochromis		Lineage	
Oreochromis () - (Rank: genus)			Parent
(https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=8139)			
8128		NCBI Taxonomy ID	
(https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=8128)			is Taxon A an Infraspecies?
No			

	Taxon B #1	Latin Name	
Takifugu rubripes			
(https://www.gephebase.org/search-criteria/?and+Taxon+and+Synonyms=^Takifugu+rubripes^#gephebase-summary-title)			
torafugu		Common Name	
Fugu rubripes; Sphaeroides rubripes; Tetraodon rubripes; torafugu; tiger puffer; Takifugu rubripes (Temminck & Schlegel, 1850)		Synonyms	
species		Rank	
cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Deuterostomia; Chordata; Craniata; Vertebrata; Gnathostomata; Teleostomi; Euteleostomi; Actinopterygii; Actinopteri; Neopterygii; Teleostei; Osteoglossocephalai; Clupeocephala; Euteleosteomorpha; Neoteleostei; Eurypterygia; Ctenosquamata; Acanthomorphata; Euacanthomorphacea; Percomorphaceae; Eupercaria; Tetraodontiformes; Tetraodontidae; Tetradontoidea; Tetraodontidae; Takifugu		Lineage	
Takifugu () - (Rank: genus)			Parent
(https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=31032)			
31033		NCBI Taxonomy ID	
(https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=31033)			is Taxon B an Infraspecies?
No			

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

	Taxon B #2	Latin Name	
Tetraodon nigroviridis			
(https://www.gephebase.org/search-criteria/?and+Taxon+and+Synonyms=^Tetraodon+nigroviridis^#gephebase-summary-title)			
spotted green pufferfish		Common Name	
spotted green pufferfish; Tetraodon nigroviridis Marion de Proce, 1822		Synonyms	
species		Rank	
cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Deuterostomia; Chordata; Craniata; Vertebrata; Gnathostomata; Teleostomi; Euteleostomi; Actinopterygii; Actinopteri; Neopterygii; Teleostei; Osteoglossocephalai; Clupeocephala; Euteleosteomorpha; Neoteleostei; Eurypterygia; Ctenosquamata; Acanthomorphata; Euacanthomorphacea; Percomorphaceae; Eupercaria; Tetraodontiformes; Tetraodontidae; Tetradontoidea; Tetraodontidae;		Lineage	

Eupercaria; Perciformes; Cottioidei; 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 Infraspecies?
 No

Tetraodon
 Parent
 Tetraodon () - (Rank: genus)
 (<https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=47144>)
 NCBI Taxonomy ID
 99883
 (<https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=99883>)
 is Taxon B an Infraspecies?
 No

GENOTYPIC CHANGE

	Generic Gene Name		UniProtKB Homo sapiens
PGA4		PoDJD7 (http://www.uniprot.org/uniprot/PoDJD7)	
-	Synonyms		GenebankID or UniProtKB
	0		
	String		
9606.ENSP00000367391 (http://string-db.org/newstring_cgi/show_network_section.pl?identifier=9606.ENSP00000367391)	Sequence Similarities		
Belongs to the peptidase A1 family.			
GO:0004190 : aspartic-type endopeptidase activity (https://www.ebi.ac.uk/QuickGO/term/GO:0004190)	GO - Molecular Function		
GO:0006508 : proteolysis (https://www.ebi.ac.uk/QuickGO/term/GO:0006508)	GO - Biological Process		
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)			
Yes (#gepheebase-summary-title)			Presumptive Null
Gene Loss (#gepheebase-summary-title)			Molecular Type
Deletion (#gepheebase-summary-title)			Aberration Type
-			Deletion Size
Absence of the gene in the genome sequence - high synteny			Molecular Details of the Mutation
Candidate Gene (#gepheebase-summary-title)			Experimental Evidence
Recurrent gene loss correlates with the evolution of stomach phenotypes in gnathostome history. (2014) (https://pubmed.ncbi.nlm.nih.gov/24307675)			Main Reference
Castro LF; Gonçalves O; Mazan S; Tay BH; Venkatesh B; Wilson JM			Authors
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 <i>kit</i> --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.		Abstract	
			Additional References

RELATED GEPHE

Related Genes
 4 (ATP4A, ATP4B, pepsinogen A1, pepsinogen A3) (<https://www.gepheebase.org/search-criteria/?or+Taxon ID=^8128^/and+Trait=Digestion/or+Taxon ID=^69293^/and+Trait=Digestion/or+Taxon ID=^31033^/and+Trait=Digestion/or+Taxon ID=^99883^/and+Trait=Digestion/and+groupHaplotypes=true#gepheebase-summary-title>)
 Related Haplotypes
 2 (<https://www.gepheebase.org/search-criteria/?or+Gene Gepheebase=^pepsinogen A2^/and+Taxon ID=^8128^/or+Gene Gepheebase=^pepsinogen A2^/and+Taxon ID=^69293^/or+Gene Gepheebase=^pepsinogen A2^/and+Taxon ID=^31033^/or+Gene Gepheebase=^pepsinogen A2^/and+Taxon ID=^99883^#gepheebase-summary-title>)

EXTERNAL LINKS

COMMENTS

There are three pepsinogen A genes in teleost fishes - their nomenclature and phylogenetic relationships are different from Mammals pepsinogen genes - Not clear if this is independent evolution in *Tetraodon nigroviridis* and in *Takifugu rubripes* (no detailed phylogenetic tree in the paper)