

GEPHE SUMMARY

ATP4A ( <a href="https://www.gephebase.org/search-criteria?/and+Gene+Gephebase=^ATP4A^#gephebase-summary-title">https://www.gephebase.org/search-criteria?/and+Gene+Gephebase=^ATP4A^#gephebase-summary-title</a> )	Gephebase Gene	GP00001922	GepheID
Published	Entry Status	Courtier	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
Digestion (absence of stomach) ( <a href="https://www.gephebase.org/search-criteria?/and+Trait=^Digestion (absence of stomach)^#gephebase-summary-title">https://www.gephebase.org/search-criteria?/and+Trait=^Digestion (absence of stomach)^#gephebase-summary-title</a> )	Trait
presence of stomach and gastric acid production	Trait State in Taxon A
loss of stomach and no gastric acid production	Trait State in Taxon B
Taxon A	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	Latin Name
Oreochromis niloticus ( <a href="https://www.gephebase.org/search-criteria?/and+Taxon+and+Synonyms=^Oreochromis niloticus^#gephebase-summary-title">https://www.gephebase.org/search-criteria?/and+Taxon+and+Synonyms=^Oreochromis niloticus^#gephebase-summary-title</a> )	
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; Clupecocephala; Euteleostomorpha; Neoteleostei; Eurypterygia; Ctenosquamata; Acanthomorpha; Euacanthomorpha; Percomorphaceae; Ovalentaria; Cichlomorphae; Cichliformes; Cichlidae; African cichlids; Pseudocrenilabrinae; Oreochromini; Oreochromis	Lineage
Oreochromis () - (Rank: genus) ( <a href="https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=8139">https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=8139</a> )	Parent
8128 ( <a href="https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=8128">https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=8128</a> )	NCBI Taxonomy ID
No	is Taxon A an Intraspecies?

Taxon B #1	Latin Name
Oryzias latipes ( <a href="https://www.gephebase.org/search-criteria?/and+Taxon+and+Synonyms=^Oryzias latipes^#gephebase-summary-title">https://www.gephebase.org/search-criteria?/and+Taxon+and+Synonyms=^Oryzias latipes^#gephebase-summary-title</a> )	
Japanese medaka	Common Name
Poecilia latipes; Japanese medaka; Japanese rice fish; medaka; Oryzias latipes (Temminck & Schlegel, 1846); Poecilia latipes Temminck & Schlegel, 1846; Orizias latipes	Synonyms
species	Rank
cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Deuterostomia; Chordata; Craniata; Vertebrata; Gnathostomata; Teleostomi; Euteleostomi; Actinopterygii; Actinopteri; Neopterygii; Teleostei; Osteoglossocephalai; Clupecocephala; Euteleostomorpha; Neoteleostei; Eurypterygia; Ctenosquamata; Acanthomorpha; Euacanthomorpha; Percomorphaceae; Ovalentaria; Atherinomorphae; Beloniformes; Adrianichthyoidei; Adrianichthyidae; Oryziinae; Oryzias	Lineage
Oryzias () - (Rank: genus) ( <a href="https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=8089">https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=8089</a> )	Parent
8090 ( <a href="https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=8090">https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=8090</a> )	NCBI Taxonomy ID
No	is Taxon B an Intraspecies?

Taxon B #2	Latin Name
Xiphophorus maculatus ( <a href="https://www.gephebase.org/search-criteria?/and+Taxon+and+Synonyms=^Xiphophorus maculatus^#gephebase-summary-title">https://www.gephebase.org/search-criteria?/and+Taxon+and+Synonyms=^Xiphophorus maculatus^#gephebase-summary-title</a> )	
southern platyfish	Common Name
Platypoecilus maculatus; southern platyfish; Platypoecilus maculatus Guenther, 1866; Xiphophorus maculatus (Guenther, 1866)	Synonyms
species	Rank
cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Deuterostomia; Chordata; Craniata; Vertebrata; Gnathostomata; Teleostomi; Euteleostomi; Actinopterygii; Actinopteri; Neopterygii; Teleostei; Osteoglossocephalai; Clupecocephala; Euteleostomorpha; Neoteleostei; Eurypterygia;	Lineage

Ctenosquamata; Acanthomorpha; Euacanthomorpha; Percormorphaceae;  
 Ovalentaria; Atherinomorphae; Cyprinodontiformes; Cyprinodontoidei; Poeciliidae;  
 Poeciliinae; Xiphophorus

Parent

Xiphophorus () - (Rank: genus)  
 (<https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=8082>)

NCBI Taxonomy ID

8083  
 (<https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=8083>)

is Taxon B an Infrapopulation?

No

## GENOTYPIC CHANGE

<p>ATP4A</p> <p>ATP6A</p> <p>9606.ENSPO0000262623          (<a href="http://string-db.org/newstring.cgi/show_network_section.pl?identifier=9606.ENSPO0000262623">http://string-db.org/newstring.cgi/show_network_section.pl?identifier=9606.ENSPO0000262623</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>P20648 (<a href="http://www.uniprot.org/uniprot/P20648">http://www.uniprot.org/uniprot/P20648</a>)</p> <p>()</p> <p>Belongs to the cation transport ATPase (P-type) (TC 3.A.3) family. Type IIC subfamily.</p> <p>GO:0005524 : ATP binding (<a href="https://www.ebi.ac.uk/QuickGO/term/GO:0005524">https://www.ebi.ac.uk/QuickGO/term/GO:0005524</a>)          GO:0000287 : magnesium ion binding (<a href="https://www.ebi.ac.uk/QuickGO/term/GO:0000287">https://www.ebi.ac.uk/QuickGO/term/GO:0000287</a>)          GO:0005391 : sodium:potassium-exchanging ATPase activity (<a href="https://www.ebi.ac.uk/QuickGO/term/GO:0005391">https://www.ebi.ac.uk/QuickGO/term/GO:0005391</a>)          GO:0008900 : potassium:proton exchanging ATPase activity (<a href="https://www.ebi.ac.uk/QuickGO/term/GO:0008900">https://www.ebi.ac.uk/QuickGO/term/GO:0008900</a>)</p> <p>GO:0034220 : ion transmembrane transport (<a href="https://www.ebi.ac.uk/QuickGO/term/GO:0034220">https://www.ebi.ac.uk/QuickGO/term/GO:0034220</a>)          GO:0015991 : ATP hydrolysis coupled proton transport (<a href="https://www.ebi.ac.uk/QuickGO/term/GO:0015991">https://www.ebi.ac.uk/QuickGO/term/GO:0015991</a>)          GO:0030007 : cellular potassium ion homeostasis (<a href="https://www.ebi.ac.uk/QuickGO/term/GO:0030007">https://www.ebi.ac.uk/QuickGO/term/GO:0030007</a>)          GO:0006883 : cellular sodium ion homeostasis (<a href="https://www.ebi.ac.uk/QuickGO/term/GO:0006883">https://www.ebi.ac.uk/QuickGO/term/GO:0006883</a>)          GO:1990573 : potassium ion import across plasma membrane (<a href="https://www.ebi.ac.uk/QuickGO/term/GO:1990573">https://www.ebi.ac.uk/QuickGO/term/GO:1990573</a>)          GO:0036376 : sodium ion export across plasma membrane (<a href="https://www.ebi.ac.uk/QuickGO/term/GO:0036376">https://www.ebi.ac.uk/QuickGO/term/GO:0036376</a>)</p> <p>GO:0005886 : plasma membrane (<a href="https://www.ebi.ac.uk/QuickGO/term/GO:0005886">https://www.ebi.ac.uk/QuickGO/term/GO:0005886</a>)          GO:0005887 : integral component of plasma membrane (<a href="https://www.ebi.ac.uk/QuickGO/term/GO:0005887">https://www.ebi.ac.uk/QuickGO/term/GO:0005887</a>)          GO:0005615 : extracellular space (<a href="https://www.ebi.ac.uk/QuickGO/term/GO:0005615">https://www.ebi.ac.uk/QuickGO/term/GO:0005615</a>)</p>	<p>UniProtKB Homo sapiens</p> <p>GenebankID or UniProtKB</p> <p>Presumptive Null</p> <p>Molecular Type</p> <p>Aberration Type</p> <p>Deletion Size</p> <p>Molecular Details of the Mutation</p> <p>Experimental Evidence</p> <p>Main Reference</p> <p>Authors</p> <p>Abstract</p>
		<p>Yes (<a href="https://www.gephebase.org/search-criteria?and+Presumptive Null=^Yes^#gephebase-summary-title">https://www.gephebase.org/search-criteria?and+Presumptive Null=^Yes^#gephebase-summary-title</a>)</p> <p>Gene Loss (<a href="https://www.gephebase.org/search-criteria?and+Molecular Type=^Gene Loss^#gephebase-summary-title">https://www.gephebase.org/search-criteria?and+Molecular Type=^Gene Loss^#gephebase-summary-title</a>)</p> <p>Deletion (<a href="https://www.gephebase.org/search-criteria?and+Aberration Type=^Deletion^#gephebase-summary-title">https://www.gephebase.org/search-criteria?and+Aberration Type=^Deletion^#gephebase-summary-title</a>)</p> <p>-</p> <p>Absence of the gene in the genome sequence - high synteny</p> <p>Candidate Gene (<a href="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</a>)</p> <p>Recurrent gene loss correlates with the evolution of stomach phenotypes in gnathostome history. (2014) (<a href="https://pubmed.ncbi.nlm.nih.gov/24307675">https://pubmed.ncbi.nlm.nih.gov/24307675</a>)</p> <p>Castro LF; Gonsalves O; Mazan S; Tay BH; Venkatesh B; Wilson JM</p>	

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.

## RELATED GEPHE

4 (ATP4B, pepsinogen A1, pepsinogen A2, pepsinogen A3) (<https://www.gephebase.org/search-criteria?/or+Taxon ID=~8128~/and+Trait=Digestion/or+Taxon ID=~8090~/and+Trait=Digestion/or+Taxon ID=~8083~/and+Trait=Digestion/and+groupHaplotypes=true#gephebase-summary-title>)

Related Genes

2 (<https://www.gephebase.org/search-criteria?/or+Gene Gephabase=^ATP4A~/and+Taxon ID=~8128~/or+Gene Gephabase=^ATP4A~/and+Taxon ID=~8090~/or+Gene Gephabase=^ATP4A~/and+Taxon ID=~8083~/#gephebase-summary-title>)

Related Haplotypes

## EXTERNAL LINKS

## COMMENTS