

GEPHE SUMMARY

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|---|---|-----------------------------------|------------------------------------|
| <p>pepsinogen A1 (https://www.gephebase.org/search-criteria?/and+Gene+Gephebase=~pepsinogen+A1~#gephebase-summary-title)</p> <p>Published</p> | <p>Gephebase Gene</p> <p>Entry Status</p> | <p>GP00001924</p> <p>Courtier</p> | <p>GepheID</p> <p>Main curator</p> |
|---|---|-----------------------------------|------------------------------------|

PHENOTYPIC CHANGE

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|---|---|
| <p>Physiology (https://www.gephebase.org/search-criteria?/and+Trait+Category=~Physiology~#gephebase-summary-title)</p> <p>Digestion (absence of stomach) (https://www.gephebase.org/search-criteria?/and+Trait=~Digestion (absence of stomach)~#gephebase-summary-title)</p> <p>presence of stomach and gastric acid production</p> <p>loss of stomach and no gastric acid production</p> <p>Taxon A</p> <p>Intergeneric or Higher (https://www.gephebase.org/search-criteria?/and+Taxonomic+Status=~Intergeneric or Higher~#gephebase-summary-title)</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> |
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|---|------------|
| Taxon A | 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; Clupeocephala; Euteleostomorpha; Neoteleostei; Eurypterygia; Ctenosquamata; Acanthomorphata; Euacanthomorphacea; Percomorphaceae; 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 | |

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

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| Taxon B #2 | Latin Name |
| Xiphophorus maculatus (https://www.gephebase.org/search-criteria?/and+Taxon+and+Synonyms=~Xiphophorus maculatus~#gephebase-summary-title) | |
| Common Name | |
| southern platyfish | |
| Synonyms | |
| Platypoecilus maculatus; southern platyfish; Platypoecilus maculatus Guenther, 1866; Xiphophorus maculatus (Guenther, 1866) | |
| Rank | |
| species | |
| Lineage | |
| 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; Euaanthomorpha; Percomorpha; Ovalentaria; Atherinomorpha; Cyprinodontiformes; Cyprinodontidae; 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 Intraspecies?

No

GENOTYPIC CHANGE

| | | | |
|--|-------------------------|--|-----------------------------------|
| PGA4 | Generic Gene Name | P0DJD7 (http://www.uniprot.org/uniprot/P0DJD7) | UniProtKB Homo sapiens |
| - | Synonyms | 0 | GenebankID or UniProtKB |
| 9606.ENSPO0000367391 (http://string-db.org/newstring.cgi/show_network_section.pl?identifier=9606.ENSPO0000367391) | String | | |
| Belongs to the peptidase A1 family. | Sequence Similarities | | |
| 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:0070062 : extracellular exosome (https://www.ebi.ac.uk/QuickGO/term/GO:0070062) | GO - Cellular Component | | |
| GO:0097486 : multivesicular body lumen (https://www.ebi.ac.uk/QuickGO/term/GO:0097486) | | | |
| Yes (https://www.gephebase.org/search-criteria?/and+Presumptive Null=^Yes^#gephebase-summary-title) | | | Presumptive Null |
| Gene Loss (https://www.gephebase.org/search-criteria?/and+Molecular Type=^Gene Loss^#gephebase-summary-title) | | | Molecular Type |
| Deletion (https://www.gephebase.org/search-criteria?/and+Aberration Type=^Deletion^#gephebase-summary-title) | | | Aberration Type |
| - | | | Deletion Size |
| Absence of the gene in the genome sequence - high synteny | | | Molecular Details of the Mutation |
| Candidate Gene (https://www.gephebase.org/search-criteria?/and+Experimental Evidence=^Candidate Gene^#gephebase-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; Gonçálves 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 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. | | | Abstract |
| | | | Additional References |

RELATED GEPHE

4 (ATP4A, ATP4B, 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

Related Haplotypes

2 (<https://www.gephebase.org/search-criteria?/or+Gene+Gephebase=~pepsinogen+A1~/and+Taxon+ID=~8128~/or+Gene+Gephebase=~pepsinogen+A1~/and+Taxon+ID=~8090~/or+Gene+Gephebase=~pepsinogen+A1~/and+Taxon+ID=~8083~#gephebase-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