GEPHE SUMMARY

Gephebase Gene

gastrin (https://www.gephebase.org/search-criteria?/and+Gene Gephebase=^gastrin^#gephebase-summary-title)

GepheID

GP00001914

Entry Status

Published

Main curator

Courtier

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

Latin Name

Monodelphis domestica (https://www.gephebase.org/search-criteria?/and+Taxon and Synonyms=^Monodelphis domestica^#gephebase-summary-title)

Common Name

gray short-tailed opossum

Synonyms

gray short-tailed opossum; Monodelphis domesticus

Rank

species

Lineage

cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Deuterostomia; Chordata; Craniata; Vertebrata; Gnathostomata; Teleostomi; Euteleostomi; Sarcopterygii; Dipnotetrapodomorpha; Tetrapoda; Amniota; Mammalia; Theria; Metatheria; Didelphimorphia; Didelphidae; Didelphinae; Monodelphis

Parent

Monodelphis (short-tailed opossums) - (Rank: genus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 13615)

NCBI Taxonomy ID

13616 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 13616)

is Taxon A an Infraspecies?

No

Taxon B

Latin Name

Ornithorhynchus anatinus (https://www.gephebase.org/search-criteria?/and+Taxon and Synonyms=^Ornithorhynchus anatinus^#gephebase-summary-title)

Common Name

platypus

Synonyms

platypus; duck-billed platypus; duckbill platypus; Ornythorhynchus anatinus

Rank

species

Lineage

cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Deuterostomia; Chordata; Craniata; Vertebrata; Gnathostomata; Teleostomi; Euteleostomi; Sarcopterygii; Dipnotetrapodomorpha; Tetrapoda; Amniota; Mammalia; Prototheria; Monotremata; Ornithorhynchidae; Ornithorhynchus

Parent

Ornithorhynchus () - (Rank: genus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 9257)

NCBI Taxonomy ID

9258 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 9258)

is Taxon B an Infraspecies?

No

GENOTYPIC CHANGE

Generic Gene Name

GAST

Synonyms

GAS

String

9606.ENSP00000331358 (http://string-db.org/newstring_cgi/show_network_section.pl?identifier= 9606.ENSP00000331358)

Sequence Similarities

Belongs to the gastrin/cholecystokinin family.

GO - Molecular Function

GO:0005179 : hormone activity (https://www.ebi.ac.uk/QuickGO/term/GO:0005179)

GO - Biological Process

GO:0007165 : signal transduction (https://www.ebi.ac.uk/QuickGO/term/GO:0007165)
GO:0007186 : G protein-coupled receptor signaling pathway (https://www.ebi.ac.uk/QuickGO/term/GO:0007186)
GO:0032094 : response to food (https://www.ebi.ac.uk/QuickGO/term/GO:0032094)

GO - Cellular Component

UniProtKB Homo sapiens

P01350 (http://www.uniprot.org/uniprot/P01350)

GenebankID or UniProtKB

()

GO:0005576 : extracellular region (https://www.ebi.ac.uk/QuickGO/term/GO:0005576)
GO:0005615 : extracellular space (https://www.ebi.ac.uk/QuickGO/term/GO:0005615)

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)

Deletion Size

-

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

Loss of genes implicated in gastric function during platypus evolution. (2008) (https://pubmed.ncbi.nlm.nih.gov/18482448)

Authors

OrdoÃ±ez GR; Hillier LW; Warren WC; GrÃ¼tzner F; LÃ³pez-OtÃn C; Puente XS

Abstract

The duck-billed platypus (Ornithorhynchus anatinus) belongs to the mammalian subclass Prototheria, which diverged from the Theria line early in mammalian evolution. The platypus genome sequence provides a unique opportunity to illuminate some aspects of the biology and evolution of these animals.

We show that several genes implicated in food digestion in the stomach have been deleted or inactivated in platypus. Comparison with other vertebrate genomes revealed that the main genes implicated in the formation and activity of gastric juice have been lost in platypus. These include the aspartyl proteases pepsinogen A and pepsinogens B/C, the hydrochloric acid secretion stimulatory hormone gastrin, and the alpha subunit of the gastric H+/K+-ATPase. Other genes implicated in gastric functions, such as the beta subunit of the H+/K+-ATPase and the aspartyl protease cathepsin E, have been inactivated because of the acquisition of loss-of-function mutations. All of these genes are highly conserved in vertebrates, reflecting a unique pattern of evolution in the platypus genome not previously seen in other mammalian genomes.

The observed loss of genes involved in gastric functions might be responsible for the anatomical and physiological differences in gastrointestinal tract between monotremes and other vertebrates, including small size, lack of glands, and high pH of the monotreme stomach. This study contributes to a better understanding of the mechanisms that underlie the evolution of the platypus genome, might extend the less-is-more evolutionary model to monotremes, and provides novel insights into the importance of gene loss events during mammalian evolution.

Additional References

RELATED GEPHE

Related Genes

7 (ATP4A, neurogenin 3, pepsinogen A, pepsinogen B, pepsinogen C, ATP4B, cathepsin E) (https://www.gephebase.org/search-criteria?/or+Taxon ID=^13616^/and+Trait=Digestion/or+Taxon ID=^9258^/and+Trait=Digestion/and+groupHaplotypes=true#gephebase-summary-title)

Related Haplotypes

No matches found.

EXTERNAL LINKS

COMMENTS

lack of acid secretion in the platypus stomach - this is a characteristic feature of monotremes whose gastric juice is above pH 6