

GEPHE SUMMARY

neurogenin 3 (https://www.gephebase.org/search-criteria?/and+Gene+Gephebase=^neurogenin 3^#gephebase-summary-title)	Gephebase Gene	GP00001915	GepheID
Published	Entry Status	Courtier	Main curator

PHENOTYPIC CHANGE

Physiology (https://www.gephebase.org/search-criteria?/and+Trait+Category=^Physiology^#gephebase-summary-title)	Trait Category		
Digestion (absence of stomach) (https://www.gephebase.org/search-criteria?/and+Trait=^Digestion (absence of stomach)^#gephebase-summary-title)	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		
	Ancestral State		
	Taxon A		
Intergeneric or Higher (https://www.gephebase.org/search-criteria?/and+Taxonomic+Status=^Intergeneric or Higher^#gephebase-summary-title)	Taxonomic Status		
	Taxon A		Taxon B
Monodelphis domestica (https://www.gephebase.org/search-criteria?/and+Taxon and Synonyms=^Monodelphis domestica^#gephebase-summary-title)	Latin Name	Ornithorhynchus anatinus (https://www.gephebase.org/search-criteria?/and+Taxon and Synonyms=^Ornithorhynchus anatinus^#gephebase-summary-title)	Latin Name
gray short-tailed opossum	Common Name	platypus	Common Name
gray short-tailed opossum; Monodelphis domesticus	Synonyms	platypus; duck-billed platypus; duckbill platypus; Ornithorhynchus anatinus	Synonyms
species	Rank	species	Rank
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	Lineage	cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Deuterostomia; Chordata; Craniata; Vertebrata; Gnathostomata; Teleostomi; Euteleostomi; Sarcopterygii; Dipnotetrapodomorpha; Tetrapoda; Amniota; Mammalia; Prototheria; Monotremata; Ornithorhynchidae; Ornithorhynchus	Lineage
Monodelphis (short-tailed opossums) - (Rank: genus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=13615)	Parent	Ornithorhynchus () - (Rank: genus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=9257)	Parent
13616 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=13616)	NCBI Taxonomy ID	9258 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=9258)	NCBI Taxonomy ID
No	is Taxon A an Intraspecies?	No	is Taxon B an Intraspecies?

GENOTYPIC CHANGE

NEUROG3	Generic Gene Name	Q9Y4Z2 (http://www.uniprot.org/uniprot/Q9Y4Z2)	UniProtKB Homo sapiens
ngn3; Atoh5; NGN-3; Math4B; bHLHa7; ATOH5; BHLHA7; NGN3	Synonyms	()	GenebankID or UniProtKB
9606.ENSPP00000242462 (http://string-db.org/newstring.cgi/show_network_section.pl?identifier=9606.ENSPP00000242462)	String		
-	Sequence Similarities		
GO:0046983 : protein dimerization activity (https://www.ebi.ac.uk/QuickGO/term/GO:0046983)	GO - Molecular Function		
GO:0001228 : DNA-binding transcription activator activity, RNA polymerase II-specific (https://www.ebi.ac.uk/QuickGO/term/GO:0001228)			
GO:0000981 : DNA-binding transcription factor activity, RNA polymerase II-specific (https://www.ebi.ac.uk/QuickGO/term/GO:0000981)			
GO:0000978 : RNA polymerase II proximal promoter sequence-specific DNA binding			

(<https://www.ebi.ac.uk/QuickGO/term/GO:0000978>)
GO:0001227 : DNA-binding transcription repressor activity, RNA polymerase II-specific
(<https://www.ebi.ac.uk/QuickGO/term/GO:0001227>)
GO:0003713 : transcription coactivator activity
(<https://www.ebi.ac.uk/QuickGO/term/GO:0003713>)
GO:0031490 : chromatin DNA binding
(<https://www.ebi.ac.uk/QuickGO/term/GO:0031490>)

GO - Biological Process

GO:0007417 : central nervous system development
(<https://www.ebi.ac.uk/QuickGO/term/GO:0007417>)
GO:0007399 : nervous system development
(<https://www.ebi.ac.uk/QuickGO/term/GO:0007399>)
GO:0007422 : peripheral nervous system development
(<https://www.ebi.ac.uk/QuickGO/term/GO:0007422>)
GO:0045944 : positive regulation of transcription by RNA polymerase II
(<https://www.ebi.ac.uk/QuickGO/term/GO:0045944>)
GO:0000122 : negative regulation of transcription by RNA polymerase II
(<https://www.ebi.ac.uk/QuickGO/term/GO:0000122>)
GO:0045666 : positive regulation of neuron differentiation
(<https://www.ebi.ac.uk/QuickGO/term/GO:0045666>)
GO:0048814 : regulation of dendrite morphogenesis
(<https://www.ebi.ac.uk/QuickGO/term/GO:0048814>)
GO:0031018 : endocrine pancreas development
(<https://www.ebi.ac.uk/QuickGO/term/GO:0031018>)
GO:0030900 : forebrain development
(<https://www.ebi.ac.uk/QuickGO/term/GO:0030900>)
GO:0030855 : epithelial cell differentiation
(<https://www.ebi.ac.uk/QuickGO/term/GO:0030855>)
GO:0051091 : positive regulation of DNA-binding transcription factor activity
(<https://www.ebi.ac.uk/QuickGO/term/GO:0051091>)
GO:0030902 : hindbrain development
(<https://www.ebi.ac.uk/QuickGO/term/GO:0030902>)
GO:0021510 : spinal cord development
(<https://www.ebi.ac.uk/QuickGO/term/GO:0021510>)
GO:0060290 : transdifferentiation (<https://www.ebi.ac.uk/QuickGO/term/GO:0060290>)

GO - Cellular Component

GO:0005737 : cytoplasm (<https://www.ebi.ac.uk/QuickGO/term/GO:0005737>)
GO:0005634 : nucleus (<https://www.ebi.ac.uk/QuickGO/term/GO:0005634>)

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

Molecular Details of the Mutation

Absence of the gene in the genome sequence - Neurogenin-3 is a transcription factor whose activity is required for the specification of gastric epithelial cell identity - Deficiency of this factor results in considerably smaller stomachs and absence of gastrin-secreting G cells: somatostatin-secreting D cells and glucagon-secreting A cells 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

Ordoñez GR; Hillier LW; Warren WC; Grützner F; López-Otin 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

7 (ATP4A, gastrin, 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 Genes

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