

GEPHE SUMMARY

		Gephebase Gene		GepheID
ameloblastin (AMBN) (https://www.gephebase.org/search-criteria?/and+Gene)			GP00001938	
Gephebase= [^] ameloblastin (AMBN) [^] #gephebase-summary-title				Main curator
		Entry Status	Courtier	
Published				

PHENOTYPIC CHANGE

		Trait Category		
Physiology (https://www.gephebase.org/search-criteria?/and+Trait)				
Category= [^] Physiology [^] #gephebase-summary-title				
		Trait		
Tooth absence (no enamel production) (<a href="https://www.gephebase.org/search-criteria?/and+Trait=<sup>^</sup>Tooth absence (no enamel production)<sup>^</sup>#gephebase-summary-title">https://www.gephebase.org/search-criteria?/and+Trait=[^]Tooth absence (no enamel production)[^]#gephebase-summary-title)				
		Trait State in Taxon A		
presence of teeth				
		Trait State in Taxon B		
absence of teeth				
		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		Taxon B		
	Latin Name		Latin Name	
Cetacea		Mysticeti		
(https://www.gephebase.org/search-criteria?/and+Taxon and)		(https://www.gephebase.org/search-criteria?/and+Taxon and)		
Synonyms= [^] Cetacea [^] #gephebase-summary-title		Synonyms= [^] Mysticeti [^] #gephebase-summary-title		
	Common Name		Common Name	
whales		baleen whales		
	Synonyms		Synonyms	
whales; cetaceans; whale; whales, dolphins, and porpoises		baleen whales		
	Rank		Rank	
order		suborder		
	Lineage		Lineage	
cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Deuterostomia;		cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Deuterostomia;		
Chordata; Craniata; Vertebrata; Gnathostomata; Teleostomi; Euteleostomi; Sarcopterygii;		Chordata; Craniata; Vertebrata; Gnathostomata; Teleostomi; Euteleostomi; Sarcopterygii;		
Dipnotetrapodomorpha; Tetrapoda; Amniota; Mammalia; Theria; Eutheria; Boreoeutheria;		Dipnotetrapodomorpha; Tetrapoda; Amniota; Mammalia; Theria; Eutheria; Boreoeutheria;		
Laurasiatheria; Cetartiodactyla		Laurasiatheria; Cetartiodactyla; Cetacea		
	Parent		Parent	
Cetartiodactyla (whales, hippos, ruminants, pigs, camels etc.) - (Rank: no rank)		Cetacea (whales) - (Rank: order)		
(https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 91561)		(https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 9721)		
	NCBI Taxonomy ID		NCBI Taxonomy ID	
9721		9761		
(https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 9721)		(https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 9761)		
	is Taxon A an Intraspecies?		is Taxon B an Intraspecies?	
No		No		

GENOTYPIC CHANGE

		Generic Gene Name		UniProtKB Homo sapiens
AMBN			Q9NP70 (http://www.uniprot.org/uniprot/Q9NP70)	
		Synonyms		GenebankID or UniProtKB
Al1F			0	
		String		
9606.ENSP00000313809				
(http://string-db.org/newstring.cgi/show_network_section.pl?identifier=9606.ENSP00000313809)				
		Sequence Similarities		
Belongs to the ameloblastin family.				
		GO - Molecular Function		
GO:0008083 : growth factor activity (https://www.ebi.ac.uk/QuickGO/term/GO:0008083)				
GO:0030345 : structural constituent of tooth enamel				
(https://www.ebi.ac.uk/QuickGO/term/GO:0030345)				
		GO - Biological Process		
GO:0007155 : cell adhesion (https://www.ebi.ac.uk/QuickGO/term/GO:0007155)				
GO:0044267 : cellular protein metabolic process				
(https://www.ebi.ac.uk/QuickGO/term/GO:0044267)				

GO:0043687 : post-translational protein modification
(<https://www.ebi.ac.uk/QuickGO/term/GO:0043687>)
GO:0042475 : odontogenesis of dentin-containing tooth
(<https://www.ebi.ac.uk/QuickGO/term/GO:0042475>)
GO:0042127 : regulation of cell proliferation
(<https://www.ebi.ac.uk/QuickGO/term/GO:0042127>)
GO:0031214 : biomineral tissue development
(<https://www.ebi.ac.uk/QuickGO/term/GO:0031214>)

GO - Cellular Component

GO:0005576 : extracellular region (<https://www.ebi.ac.uk/QuickGO/term/GO:0005576>)
GO:0005788 : endoplasmic reticulum lumen
(<https://www.ebi.ac.uk/QuickGO/term/GO:0005788>)

Yes (<https://www.gephebase.org/search-criteria?/and+Presumptive+Null=~Yes^#gephebase-summary-title>)

Presumptive Null

Coding (<https://www.gephebase.org/search-criteria?/and+Molecular+Type=~Coding^#gephebase-summary-title>)

Molecular Type

Unknown (<https://www.gephebase.org/search-criteria?/and+Aberration+Type=~Unknown^#gephebase-summary-title>)

Aberration Type

multiple frameshift mutations

Molecular Details of the Mutation

Candidate Gene (<https://www.gephebase.org/search-criteria?/and+Experimental+Evidence=~Candidate+Gene^#gephebase-summary-title>)

Experimental Evidence

Morphological and molecular evidence for a stepwise evolutionary transition from teeth to baleen in mysticete whales. (2008) (<https://pubmed.ncbi.nlm.nih.gov/18266181>)

Main Reference

DemÃ©rÃ© TA; McGowen MR; Berta A; Gatesy J

Authors

The origin of baleen in mysticete whales represents a major transition in the phylogenetic history of Cetacea. This key specialization, a keratinous sieve that enables filter-feeding, permitted exploitation of a new ecological niche and heralded the evolution of modern baleen-bearing whales, the largest animals on Earth. To date, all formally described mysticete fossils conform to two types: toothed species from Oligocene-age rocks (approximately 24 to 34 million years old) and toothless species that presumably utilized baleen to feed (Recent to approximately 30 million years old). Here, we show that several Oligocene toothed mysticetes have nutrient foramina and associated sulci on the lateral portions of their palates, homologous structures in extant mysticetes house vessels that nourish baleen. The simultaneous occurrence of teeth and nutrient foramina implies that both teeth and baleen were present in these early mysticetes. Phylogenetic analyses of a supermatrix that includes extinct taxa and new data for 11 nuclear genes consistently resolve relationships at the base of Mysticeti. The combined data set of 27,340 characters supports a stepwise transition from a toothed ancestor, to a mosaic intermediate with both teeth and baleen, to modern baleen whales that lack an adult dentition but retain developmental and genetic evidence of their ancestral toothed heritage. Comparative sequence data for ENAM (enamelin) and AMBN (ameloblastin) indicate that enamel-specific loci are present in Mysticeti but have degraded to pseudogenes in this group. The dramatic transformation in mysticete feeding anatomy documents an apparently rare, stepwise mode of evolution in which a composite phenotype bridged the gap between primitive and derived morphologies; a combination of fossil and molecular evidence provides a multifaceted record of this macroevolutionary pattern.

Abstract

Pseudogenization of the tooth gene enamelysin (MMP20) in the common ancestor of extant baleen whales. (2011) (<https://pubmed.ncbi.nlm.nih.gov/20861053>)

Additional References

RELATED GEPHE

3 (amelogenin (AMEL), enamelin (ENAM), enamelysin (MMP20)) (<https://www.gephebase.org/search-criteria?/or+Taxon+ID=~9721^/and+Trait=Tooth+absence/or+Taxon+ID=~9761^/and+Trait=Tooth+absence/and+groupHaplotypes=true#gephebase-summary-title>)

Related Genes

No matches found.

Related Haplotypes

EXTERNAL LINKS

COMMENTS

Cladistic analyses suggest that functional teeth were lost in the common ancestor of crown-group Mysticeti. The amelogenin (AMEL) gene contains various gene null mutations in various species. It is possible that frameshift mutations and/or stop codons will be discovered in the unsequenced protein-coding regions of one or more of these extracellular matrix protein (EMP) genes. A second possibility is that one or more of these genes were initially silenced by mutations in a regulatory gene region on the ancestral mysticete branch, and that mutations in protein-coding regions accumulated subsequently on descendant branches within crown-group Mysticeti. A third possibility is that a different enamel- or tooth-specific gene was knocked out in the common ancestor of mysticetes and that AMBN ENAM and AMEL acquired molecular cavities on descendant branches within crown-group Mysticeti. Alternatively enamel may have been lost independently in several mysticete lineages rather than once in the common ancestor of crown mysticetes.

