

GEPHE SUMMARY

		Gephebase Gene		GepheID
enamelin (ENAM) (https://www.gephebase.org/search-criteria?/and+Gene)			GP00001943	
Gephebase="enamelin (ENAM)"#gephebase-summary-title)				Main curator
Published		Entry Status	Courtier	

PHENOTYPIC CHANGE

		Trait Category		
Physiology (https://www.gephebase.org/search-criteria?/and+Trait)				
Category="Physiology"#gephebase-summary-title)		Trait		
Tooth composition (no enamel production) (<a (no="" composition="" enamel="" href="https://www.gephebase.org/search-criteria?/and+Trait=" production)"#gephebase-summary-title"="" tooth="">https://www.gephebase.org/search-criteria?/and+Trait="Tooth composition (no enamel production)"#gephebase-summary-title)				
presence of enamel		Trait State in Taxon A		
absence of enamel		Trait State in Taxon B		
Taxon A		Ancestral State		
Intergeneric or Higher (https://www.gephebase.org/search-criteria?/and+Taxonomic)		Taxonomic Status		
Status="Intergeneric or Higher"#gephebase-summary-title)				
Taxon A			Taxon B	
		Latin Name		Latin Name
Elephantulus rufescens (https://www.gephebase.org/search-criteria?/and+Taxon and Synonyms="Elephantulus rufescens"#gephebase-summary-title)			Orycteropus afer (<a afer"#gephebase-summary-title"="" href="https://www.gephebase.org/search-criteria?/and+Taxon and Synonyms=" orycteropus="">https://www.gephebase.org/search-criteria?/and+Taxon and Synonyms="Orycteropus afer"#gephebase-summary-title)	
East African long-eared elephant shrew		Common Name	aardvark	Common Name
East African long-eared elephant shrew; rufous elephant shrew		Synonyms	aardvark; Orycteropus afer (Pallas, 1766)	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; Eutheria; Afrotheria; Macroscelidea; Macroscelididae; Elephantulus		Lineage	cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Deuterostomia; Chordata; Craniata; Vertebrata; Gnathostomata; Teleostomi; Euteleostomi; Sarcopterygii; Dipnotetrapodomorpha; Tetrapoda; Amniota; Mammalia; Theria; Eutheria; Afrotheria; Tubulidentata; Orycteropodidae; Orycteropus	Lineage
Elephantulus (long-eared elephant shrews) - (Rank: genus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=28736)		Parent	Orycteropus () - (Rank: genus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=9818)	Parent
42151 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=42151)		NCBI Taxonomy ID	9818 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=9818)	NCBI Taxonomy ID
No		is Taxon A an Intraspecies?	No	is Taxon B an Intraspecies?

GENOTYPIC CHANGE

		Generic Gene Name		UniProtKB Homo sapiens
ENAM			Q9NRM1 (http://www.uniprot.org/uniprot/Q9NRM1)	
ADA1; AI1C; AIH2		Synonyms	()	GenebankID or UniProtKB
9606.ENSP00000379383 (http://string-db.org/newstring.cgi/show_network_section.pl?identifier=9606.ENSP00000379383)		String		
-		Sequence Similarities		
GO:0030345 : structural constituent of tooth enamel (https://www.ebi.ac.uk/QuickGO/term/GO:0030345)		GO - Molecular Function		
GO:0044267 : cellular protein metabolic process (https://www.ebi.ac.uk/QuickGO/term/GO:0044267)		GO - Biological Process		
GO:0043687 : post-translational protein modification				

(<https://www.ebi.ac.uk/QuickGO/term/GO:0043687>)
 GO:0031214 : biomineral tissue development
 (<https://www.ebi.ac.uk/QuickGO/term/GO:0031214>)
 GO:0036305 : ameloblast differentiation
 (<https://www.ebi.ac.uk/QuickGO/term/GO:0036305>)
 GO:0097186 : amelogenesis (<https://www.ebi.ac.uk/QuickGO/term/GO:0097186>)
 GO:0070175 : positive regulation of enamel mineralization
 (<https://www.ebi.ac.uk/QuickGO/term/GO:0070175>)
 GO:0022604 : regulation of cell morphogenesis
 (<https://www.ebi.ac.uk/QuickGO/term/GO:0022604>)

GO - Cellular Component

GO:0031012 : extracellular matrix (<https://www.ebi.ac.uk/QuickGO/term/GO:0031012>)
 GO:0005788 : endoplasmic reticulum lumen
 (<https://www.ebi.ac.uk/QuickGO/term/GO:0005788>)

Mutation #1

Yes ([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))

Presumptive Null

Coding ([https://www.gephebase.org/search-criteria?/and+Molecular Type+Coding^#gephebase-summary-title](https://www.gephebase.org/search-criteria?/and+Molecular+Type+Coding^#gephebase-summary-title))

Molecular Type

Insertion ([https://www.gephebase.org/search-criteria?/and+Aberration Type+Insertion^#gephebase-summary-title](https://www.gephebase.org/search-criteria?/and+Aberration+Type+Insertion^#gephebase-summary-title))

Aberration Type

1-9 bp

Insertion Size

1-bp insertion at position 2649 and 1-bp insertion at position 3678 and 1-bp deletion at position 4041

Molecular Details of the Mutation

Candidate Gene ([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))

Experimental Evidence

Molecular decay of the tooth gene Enamelin (ENAM) mirrors the loss of enamel in the fossil record of placental mammals. (2009) (<https://pubmed.ncbi.nlm.nih.gov/19730686>)

Main Reference

Meredith RW; Gatesy J; Murphy WJ; Ryder OA; Springer MS

Authors

Vestigial structures occur at both the anatomical and molecular levels, but studies documenting the co-occurrence of morphological degeneration in the fossil record and molecular decay in the genome are rare. Here, we use morphology, the fossil record, and phylogenetics to predict the occurrence of "molecular fossils" of the enamel (ENAM) gene in four different orders of placental mammals (Tubulidentata, Pholidota, Cetacea, Xenarthra) with toothless and/or enamelless taxa. Our results support the "molecular fossil" hypothesis and demonstrate the occurrence of frameshift mutations and/or stop codons in all toothless and enamelless taxa. We then use a novel method based on selection intensity estimates for codons (omega) to calculate the timing of iterated enamel loss in the fossil record of aardvarks and pangolins, and further show that the molecular evolutionary history of ENAM predicts the occurrence of enamel in basal representatives of Xenarthra (sloths, anteaters, armadillos) even though frameshift mutations are ubiquitous in ENAM sequences of living xenarthrans. The molecular decay of ENAM parallels the morphological degeneration of enamel in the fossil record of placental mammals and provides manifest evidence for the predictive power of Darwin's theory.

Abstract

Additional References

Mutation #2

Yes ([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))

Presumptive Null

Coding ([https://www.gephebase.org/search-criteria?/and+Molecular Type+Coding^#gephebase-summary-title](https://www.gephebase.org/search-criteria?/and+Molecular+Type+Coding^#gephebase-summary-title))

Molecular Type

Deletion ([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))

Aberration Type

1-9 bp

Deletion Size

1-bp insertion at position 2649 and 1-bp insertion at position 3678 and 1-bp deletion at position 4041

Molecular Details of the Mutation

Candidate Gene ([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))

Experimental Evidence

Molecular decay of the tooth gene Enamelin (ENAM) mirrors the loss of enamel in the fossil record of placental mammals. (2009) (<https://pubmed.ncbi.nlm.nih.gov/19730686>)

Main Reference

Meredith RW; Gatesy J; Murphy WJ; Ryder OA; Springer MS

Authors

Vestigial structures occur at both the anatomical and molecular levels, but studies documenting the co-occurrence of morphological degeneration in the fossil record and molecular decay in the genome are rare. Here, we use morphology, the fossil record, and phylogenetics to predict the occurrence of "molecular fossils" of the enamel (ENAM) gene in four different orders of placental mammals (Tubulidentata, Pholidota, Cetacea, Xenarthra) with toothless and/or enamelless taxa. Our results support the "molecular fossil" hypothesis and demonstrate the occurrence of frameshift mutations and/or stop codons in all toothless and enamelless taxa. We then use a novel method based on selection intensity estimates for codons (omega) to calculate the timing of iterated enamel loss in the fossil record of aardvarks and pangolins, and further show that the molecular evolutionary history of ENAM predicts the occurrence of enamel in basal representatives of Xenarthra (sloths, anteaters, armadillos) even though frameshift mutations are ubiquitous in ENAM sequences of living xenarthrans. The molecular decay of ENAM parallels the morphological degeneration of enamel in the fossil record of placental mammals and provides manifest evidence for the predictive power of Darwin's theory.

Abstract

Additional References

Mutation #3

Yes ([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))

Presumptive Null

Coding (<https://www.gephebase.org/search-criteria?/and+Molecular+Type=%5Coding%5C#gephebase-summary-title>)

Molecular Type

Deletion (<https://www.gephebase.org/search-criteria?/and+Aberration+Type=%5CDeletion%5C#gephebase-summary-title>)

Aberration Type

1-9 bp

Deletion Size

1-bp insertion at position 2649 and 1-bp insertion at position 3678 and 1-bp deletion at position 4041

Molecular Details of the Mutation

Candidate Gene (<https://www.gephebase.org/search-criteria?/and+Experimental+Evidence=%5CCandidate+Gene%5C#gephebase-summary-title>)

Experimental Evidence

Molecular decay of the tooth gene Enamelin (ENAM) mirrors the loss of enamel in the fossil record of placental mammals. (2009) (<https://pubmed.ncbi.nlm.nih.gov/19730686>)

Main Reference

Meredith RW; Gatesy J; Murphy WJ; Ryder OA; Springer MS

Authors

Vestigial structures occur at both the anatomical and molecular levels, but studies documenting the co-occurrence of morphological degeneration in the fossil record and molecular decay in the genome are rare. Here, we use morphology, the fossil record, and phylogenetics to predict the occurrence of "molecular fossils" of the enamelin (ENAM) gene in four different orders of placental mammals (Tubulidentata, Pholidota, Cetacea, Xenarthra) with toothless and/or enamelless taxa. Our results support the "molecular fossil" hypothesis and demonstrate the occurrence of frameshift mutations and/or stop codons in all toothless and enamelless taxa. We then use a novel method based on selection intensity estimates for codons (omega) to calculate the timing of iterated enamel loss in the fossil record of armadillos and pangolins, and further show that the molecular evolutionary history of ENAM predicts the occurrence of enamel in basal representatives of Xenarthra (sloths, anteaters, armadillos) even though frameshift mutations are ubiquitous in ENAM sequences of living xenarthrans. The molecular decay of ENAM parallels the morphological degeneration of enamel in the fossil record of placental mammals and provides manifest evidence for the predictive power of Darwin's theory.

Abstract

Additional References

RELATED GEPHE

No matches found.

Related Genes

No matches found.

Related Haplotypes

EXTERNAL LINKS

COMMENTS

@ParrallelEvolution in baleen whales. Teeth in the extant armadillo *Oryzomys afer* lack both enamel and a central pulp cavity and are composed of 1500 thin hexagonal tubes of dentin that are bound together by cementum