GEPHE SUMMARY

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

GepheID
GP00001944

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
Tooth composition (no enamel production) (https://www.gephebase.org/search-criteria?/and+Trait=^Tooth composition (no enamel production)^#gephebase-summary-title)

Trait State in Taxon A
presence of enamel

Trait State in Taxon B
absence of enamel

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

Common Name
dog

Synonyms
Canis canis; Canis domesticus; Canis familiaris; dog; dogs; Canis familiaris Linnaeus, 1758; Canis lupus familiaris Linnaeus, 1758

Rank
subspecies

Lineage
cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Deuterostomia; Chordata; Craniata; Vertebrata; Gnathostomata; Teleostomi; Euteleostomi; Sarcopterygii; Dipnotetrapodomorpha; Tetrapoda; Amniota; Mammalia; Theria; Eutheria; Boreoeutheria; Laurasiatheria; Carnivora; Caniformia; Canidae; Canis; Canis lupus

Parent
Canis lupus (gray wolf) - (Rank: species) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 9612)

NCBI Taxonomy ID
9615 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 9615)

is Taxon A an Infraspecies?
No

Taxon B #1

Latin Name
Manis pentadactyla (https://www.gephebase.org/search-criteria?/and+Taxon and Synonyms=^Manis pentadactyla^#gephebase-summary-title)

Common Name
Chinese pangolin

Synonyms
Chinese pangolin; Manis pentadactyla Linnaeus, 1758

Rank
species

Lineage
cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Deuterostomia; Chordata; Craniata; Vertebrata; Gnathostomata; Teleostomi; Euteleostomi; Sarcopterygii; Dipnotetrapodomorpha; Tetrapoda; Amniota; Mammalia; Theria; Eutheria; Boreoeutheria; Laurasiatheria; Pholidota; Manidae; Manis

Parent
Manis () - (Rank: genus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 9973)

NCBI Taxonomy ID
143292 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 143292)

is Taxon B an Infraspecies?
No

Taxon B #2

Latin Name
Manis tricuspis (https://www.gephebase.org/search-criteria?/and+Taxon and Synonyms=^Manis tricuspis^#gephebase-summary-title)

Common Name
Tree pangolin

Synonyms
Phataginus tricuspis; Tree pangolin; Manis tricuspis Rafinesque, 1821

Rank
species

Lineage
cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Deuterostomia; Chordata; Craniata; Vertebrata; Gnathostomata; Teleostomi; Euteleostomi; Sarcopterygii; Dipnotetrapodomorpha; Tetrapoda; Amniota; Mammalia; Theria; Eutheria; Boreoeutheria; Laurasiatheria; Pholidota; Manidae; Manis

Parent
Manis () - (Rank: genus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 9973)

NCBI Taxonomy ID
358128 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 358128)

is Taxon B an Infraspecies?

No

GENOTYPIC CHANGE

Generic Gene Name

ENAM

Synonyms

ADAI; AI1C; AIH2

String

9606.ENSP00000379383
(http://string-db.org/newstring_cgi/show_network_section.pl?identifier=
9606.ENSP00000379383)

Sequence Similarities

-

GO - Molecular Function

GO:0030345 : structural constituent of tooth enamel
(https://www.ebi.ac.uk/QuickGO/term/GO:0030345)

GO - Biological Process

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: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)

UniProtKB Homo sapiens

Q9NRM1 (http://www.uniprot.org/uniprot/Q9NRM1)

GenebankID or UniProtKB

()

Presumptive Null

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

Molecular Type

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

Aberration Type

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

Molecular Details of the Mutation

multiple deletions and insertions less than 9bp causing frameshift

Experimental Evidence

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

Main Reference

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)

Authors

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

Abstract

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 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.

Additional References

RELATED GEPHE

Related Genes

No matches found.

Related Haplotypes

1 (https://www.gephebase.org/search-criteria?/or+Gene Gephebase=^enamelin (ENAM)^/and+Taxon ID=^9615^/or+Gene Gephebase=^enamelin (ENAM)^/and+Taxon ID=^143292^/or+Gene Gephebase=^enamelin (ENAM)^/and+Taxon ID=^358128^#gephebase-summary-title)

EXTERNAL LINKS

COMMENTS

@ParrallelEvolution in baleen whales.