GEPHE SUMMARY

Gephebase Gene
ribonuclease 1B (RNase1B) (https://www.gephebase.org/search-criteria?/and+Gene Gephebase=^ribonuclease 1B (RNase1B)^#gephebase-summary-title)

Entry Status
Published

GepheID
GP00000987

Main curator
Courtier

PHENOTYPIC CHANGE

Trait Category
Physiology (https://www.gephebase.org/search-criteria?/and+Trait Category=^Physiology^#gephebase-summary-title)

Trait
Optimal enzymatic pH (https://www.gephebase.org/search-criteria?/and+Trait=^Optimal enzymatic pH^#gephebase-summary-title)

Trait State in Taxon A
Primate ancestor

Trait State in Taxon B
Pygathrix nemaeus

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

Common Name
-

Synonyms
Primata; Primates Linnaeus, 1758

Rank
order

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

Parent
Euarchontoglires () - (Rank: superorder) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 314146)

NCBI Taxonomy ID
9443 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 9443)

is Taxon A an Infraspecies?
No

Taxon B

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

Common Name
Red shanked douc langur

Synonyms
Red shanked douc langur; dove langur

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; Euarchontoglires; Primates; Haplorrhini; Simiiformes; Catarrhini; Cercopithecoidea; Cercopithecidae; Colobinae; Pygathrix

Parent
Pygathrix () - (Rank: genus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 54132)

NCBI Taxonomy ID
54133 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 54133)

is Taxon B an Infraspecies?
No

GENOTYPIC CHANGE

Generic Gene Name
RNASE1B

Synonyms
-

String
-

Sequence Similarities
Belongs to the pancreatic ribonuclease family.

GO - Molecular Function
GO:0003676 : nucleic acid binding (https://www.ebi.ac.uk/QuickGO/term/GO:0003676)
GO:0004522 : ribonuclease A activity (https://www.ebi.ac.uk/QuickGO/term/GO:0004522)

GO - Biological Process
-

GO - Cellular Component
GO:0005576 : extracellular region (https://www.ebi.ac.uk/QuickGO/term/GO:0005576)

UniProtKB Pygathrix nemaeus
Q8SPN3 (http://www.uniprot.org/uniprot/Q8SPN3)

GenebankID or UniProtKB
AF449643 (https://www.ncbi.nlm.nih.gov/nuccore/AF449643)

Mutation #1

Presumptive Null

No (https://www.gephebase.org/search-criteria?/and+Presumptive Null=^No^#gephebase-summary-title)

Molecular Type

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

Aberration Type

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

SNP Coding Change

Nonsynonymous

Molecular Details of the Mutation

R4Q; K6E; R39W - these three amino acid are sufficient to change the properties of the enzyme - no test of single amino acid changes - the fact that they evolved independently in another lineage suggests that they all have a phenotypic effect

Experimental Evidence

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

	Taxon A	Taxon B	Position
Codon	-	-	-
Amino-acid	Arg	Gln	4

Main Reference

Parallel adaptive origins of digestive RNases in Asian and African leaf monkeys. (2006) (https://pubmed.ncbi.nlm.nih.gov/16767103)

Authors

Zhang J

Abstract

Similar morphological or physiological changes occurring in multiple evolutionary lineages are not uncommon. Such parallel changes are believed to be adaptive, because a complex character is unlikely to originate more than once by chance. However, the occurrence of adaptive parallel amino acid substitutions is debated. Here I propose four requirements for establishing adaptive parallel evolution at the protein sequence level and use these criteria to demonstrate such a case. I report that the gene encoding pancreatic ribonuclease was duplicated independently in Asian and African leaf-eating monkeys. Statistical analyses of DNA sequences, functional assays of reconstructed ancestral proteins and site-directed mutagenesis show that the new genes acquired enhanced digestive efficiencies through parallel amino acid replacements driven by darwinian selection. They also lost a non-digestive function independently, under a relaxed selective constraint. These results demonstrate that despite the overall stochasticity, even molecular evolution has a certain degree of repeatability and predictability under the pressures of natural selection.

Additional References

Mutation #2

Presumptive Null

No (https://www.gephebase.org/search-criteria?/and+Presumptive Null=^No^#gephebase-summary-title)

Molecular Type

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

Aberration Type

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

SNP Coding Change

Nonsynonymous

Molecular Details of the Mutation

R4Q; K6E; R39W - these three amino acid are sufficient to change the properties of the enzyme - no test of single amino acid changes - the fact that they evolved independently in another lineage suggests that they all have a phenotypic effect

Experimental Evidence

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

	Taxon A	Taxon B	Position
Codon	-	-	-
Amino-acid	Lys	Glu	6

Main Reference

Parallel adaptive origins of digestive RNases in Asian and African leaf monkeys. (2006) (https://pubmed.ncbi.nlm.nih.gov/16767103)

Authors

Zhang J

Abstract

Similar morphological or physiological changes occurring in multiple evolutionary lineages are not uncommon. Such parallel changes are believed to be adaptive, because a complex character is unlikely to originate more than once by chance. However, the occurrence of adaptive parallel amino acid substitutions is debated. Here I propose four requirements for establishing adaptive parallel evolution at the protein sequence level and use these criteria to demonstrate such a case. I report that the gene encoding pancreatic ribonuclease was duplicated independently in Asian and African leaf-eating monkeys. Statistical analyses of DNA sequences, functional assays of reconstructed ancestral proteins and site-directed mutagenesis show that the new genes acquired enhanced digestive efficiencies through parallel amino acid replacements driven by darwinian selection. They also lost a non-digestive function independently, under a relaxed selective constraint. These results demonstrate that despite the overall stochasticity, even molecular evolution has a certain degree of repeatability and predictability under the pressures of natural selection.

Additional References

Mutation #3

Presumptive Null

No (https://www.gephebase.org/search-criteria?/and+Presumptive Null=^No^#gephebase-summary-title)

Molecular Type

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

Aberration Type

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

SNP Coding Change

Nonsynonymous

Molecular Details of the Mutation

R4Q; K6E; R39W - these three amino acid are sufficient to change the properties of the enzyme - no test of single amino acid changes - the fact that they evolved independently in another lineage suggests that they all have a phenotypic effect

Experimental Evidence

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

	Taxon A	Taxon B	Position
Codon	-	-	-
Amino-acid	Arg	Trp	39

Main Reference

Parallel adaptive origins of digestive RNases in Asian and African leaf monkeys. (2006) (https://pubmed.ncbi.nlm.nih.gov/16767103)

Authors

Zhang J

Abstract

Similar morphological or physiological changes occurring in multiple evolutionary lineages are not uncommon. Such parallel changes are believed to be adaptive, because a complex character is unlikely to originate more than once by chance. However, the occurrence of adaptive parallel amino acid substitutions is debated. Here I propose four requirements for establishing adaptive parallel evolution at the protein sequence level and use these criteria to demonstrate such a case. I report that the gene encoding pancreatic ribonuclease was duplicated independently in Asian and African leaf-eating monkeys. Statistical analyses of DNA sequences, functional assays of reconstructed ancestral proteins and site-directed mutagenesis show that the new genes acquired enhanced digestive efficiencies through parallel amino acid replacements driven by darwinian selection. They also lost a non-digestive function independently, under a relaxed selective constraint. These results demonstrate that despite the overall stochasticity, even molecular evolution has a certain degree of repeatability and predictability under the pressures of natural selection.

Additional References

RELATED GEPHE

Related Genes

No matches found.

Related Haplotypes

1 (https://www.gephebase.org/search-criteria?/or+Gene Gephebase=^ribonuclease 1B (RNase1B)^/and+Taxon ID=^9443^/or+Gene Gephebase=^ribonuclease 1B (RNase1B)^/and+Taxon ID=^54133^#gephebase-summary-title)

EXTERNAL LINKS

COMMENTS