GEPHE SUMMARY Gephebase Gene GephelD ribonuclease 1B (RNase1B) (https://www.gephebase.org/search-criteria?/and+Gene GP00000988 Gephebase=^ribonuclease 1B (RNase1B)^#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 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 Colobus auereza Ancestral State Data not curated Taxonomic Status  $Intergeneric\ or\ Higher\ (https://www.gephebase.org/search-criteria?/and+Taxonomic) and the property of the$ Status=^Intergeneric or Higher^#gephebase-summary-title) Taxon A Taxon B Latin Name Latin Name Primates Colobus guereza (https://www.gephebase.org/search-criteria?/and+Taxon and (https://www.gephebase.org/search-criteria?/and+Taxon and Synonyms=^Colobus  $Synonyms = ^{Primates} \# gephebase - summary - title)$ guereza^#gephebase-summary-title) Common Name Common Name mantled quereza Synonyms Primata; Primates Linnaeus, 1758 Colobus abyssinicus; mantled guereza; eastern black-and -white colobus; guereza; Colobus Rank abyssinicus (Oken, 1816); Colobus guereza Rueppell, 1835 orde Rank Lineage cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Deuterostomia; Lineage cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Deuterostomia; Chordata; Craniata; Vertebrata; Gnathostomata; Teleostomi; Euteleostomi; Sarcopterygii; Dipnotetrapodomorpha; Tetrapoda; Amniota; Mammalia; Theria; Eutheria; Boreoeutheria; Chordata; Craniata; Vertebrata; Gnathostomata; Teleostomi; Euteleostomi; Sarcopterygii; Dipnotetrapodomorpha; Tetrapoda; Amniota; Mammalia; Theria; Eutheria; Boreoeutheria; Euarchontoglires Parent Euarchontoglires; Primates; Haplorrhini; Simiiformes; Catarrhini; Cercopithecoidea; Euarchontoglires () - (Rank: superorder) Cercopithecidae; Colobinae; Colobus (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 314146 ) Parent NCBI Taxonomy ID Colobus (black-and-white colobus monkeys) - (Rank: genus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 9570 ) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 9443 ) NCBI Taxonomy ID is Taxon A an Infraspecies? No (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 33548 ) is Taxon B an Infraspecies? Nο **GENOTYPIC CHANGE** 

 $GO:0005576: extracellular\ region\ (https://www.ebi.ac.uk/QuickGO/term/GO:0005576)$ 

Generic Gene Name UniProtKB Pygathrix nemaeus RNASE1B Q8SPN3 (http://www.uniprot.org/uniprot/Q8SPN3) GenebankID or UniProtKB Synonyms 0 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

Mutation #1

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

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

Molecular Type

SNP Coding Change

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

Aberration Type

Presumptive Null

Nonsynonymous

Molecular Details of the Mutation

The three amino acid changes R4Q K6E R39W have a phenotypic effect in combination - the effect of a single amino acid change has not been tested - 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

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

Presumptive Null

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

Molecular Type

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

Aberration Type

SNP Coding Change

Nonsynonymous

Molecular Details of the Mutation

The three amino acid changes R4Q K6E R39W have a phenotypic effect in combination - the effect of a single amino acid change has not been tested - 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	-	<del>-</del>	<del>-</del>
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

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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

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

Presumptive Null

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

The three amino acid changes R4Q K6E R39W have a phenotypic effect in combination - the effect of a single amino acid change has not been tested - 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	<del>-</del>	-	-
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

 $1 \ (https://www.gephebase.org/search-criteria?/or+Gene\ Gephebase=^ribonuclease\ 1B\ (RNase1B)^/and+Taxon\ ID=^9443^/or+Gene\ Gephebase=^ribonuclease\ 1B\ (RNase1B)^/and+Taxon\ ID=^33548^#gephebase-summary-title)$ 

**EXTERNAL LINKS** 

COMMENTS