GEPHE SUMMARY

Gephebase Gene

eosinophil-derived neurotoxin (EDN) (https://www.gephebase.org/search-criteria?/and+Gene Gephebase=^eosinophil-derived neurotoxin (EDN)^#gephebase-summary-title)

Entry Status

Published

GepheID

GP00000272

Main curator

Martin

PHENOTYPIC CHANGE

Trait Category

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

Trait

Increase in antiviral ribonuclease activity (https://www.gephebase.org/search-criteria?/and+Trait=^Increase in antiviral ribonuclease activity^#gephebase-summary-title)

Trait State in Taxon A

Primate ancestor

Trait State in Taxon B

Hominoid and Old World Monkey ancestor

Ancestral State

Data not curated

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

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

Common Name

-

Synonyms

-

Rank

parvorder

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

Parent

Simiiformes () - (Rank: infraorder)
(https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 314293)

NCBI Taxonomy ID

9526
(https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 9526)

is Taxon B an Infraspecies?

No

GENOTYPIC CHANGE

Generic Gene Name

RNASE2

Synonyms

EDN; RAF3; RNS2

String

9606.ENSP00000303276
(http://string-db.org/newstring_cgi/show_network_section.pl?identifier= 9606.ENSP00000303276)

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:0004540 : ribonuclease activity (https://www.ebi.ac.uk/QuickGO/term/GO:0004540)

GO - Biological Process

GO:0006935 : chemotaxis (https://www.ebi.ac.uk/QuickGO/term/GO:0006935)

UniProtKB Homo sapiens

P10153 (http://www.uniprot.org/uniprot/P10153)

GenebankID or UniProtKB

AAA50284 (https://www.ncbi.nlm.nih.gov/nuccore/AAA50284)

GO:0051607 : defense response to virus
(https://www.ebi.ac.uk/QuickGO/term/GO:0051607)
GO:0043312 : neutrophil degranulation
(https://www.ebi.ac.uk/QuickGO/term/GO:0043312)
GO:0006401 : RNA catabolic process
(https://www.ebi.ac.uk/QuickGO/term/GO:0006401)
GO:0090501 : RNA phosphodiester bond hydrolysis
(https://www.ebi.ac.uk/QuickGO/term/GO:0090501)

GO - Cellular Component

GO:0070062 : extracellular exosome (https://www.ebi.ac.uk/QuickGO/term/GO:0070062)
GO:0005576 : extracellular region (https://www.ebi.ac.uk/QuickGO/term/GO:0005576)
GO:0035578 : azurophil granule lumen
(https://www.ebi.ac.uk/QuickGO/term/GO:0035578)

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

Arg64Ser

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	-	-	-

Main Reference

Complementary advantageous substitutions in the evolution of an antiviral RNase of higher primates. (2002) (https://pubmed.ncbi.nlm.nih.gov/11917138)

Authors

Zhang J; Rosenberg HF

Abstract

An improved understanding of the evolution of gene function at the molecular level may provide significant insights into the origin of biological novelty and adaptation. With the approach of ancestral protein reconstruction, we here address the question of how a dramatically enhanced ribonucleolytic activity and the related antiviral activity evolved in a recently duplicated ribonuclease (eosinophil-derived neurotoxin) gene of higher primates. We show that the mother gene of the duplicated genes had already possessed a weak antiviral activity before duplication. After duplication, substitutions at two interacting sites (Arg-64-->Ser and Thr-132-->Arg) resulted in a 13-fold enhancement of the ribonucleolytic activity of eosinophil-derived neurotoxin. These substitutions are also necessary for the potent antiviral activity, with contributions from additional amino acid changes at interacting sites. Our observation that a change in eosinophil-derived neurotoxin function occurs only when both interacting sites are altered indicates the importance of complementary substitutions in protein evolution. Thus, neutral substitutions are not simply "noises" in protein evolution, as many have thought. They may play constructive roles by setting the intramolecular microenvironment for further complementary advantageous substitutions, which can lead to improved or altered function. Overall, our study illustrates the power of the "paleomolecular biochemistry" approach in delineating the complex interplays of amino acid substitutions in evolution and in identifying the molecular basis of biological innovation.

Additional References

RELATED GEPHE

Related Genes

No matches found.

Related Haplotypes

1 (https://www.gephebase.org/search-criteria?/or+Gene Gephebase=^eosinophil-derived neurotoxin (EDN)^/and+Taxon ID=^9443^/or+Gene Gephebase=^eosinophil-derived neurotoxin (EDN)^/and+Taxon ID=^9526^#gephebase-summary-title)

EXTERNAL LINKS

COMMENTS