

GEPHE SUMMARY

|                                                                                                                                                                                                                                                                                                             |                |            |              |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|------------|--------------|
|                                                                                                                                                                                                                                                                                                             | Gephebase Gene |            | GepheID      |
| eosinophil-derived neurotoxin (EDN) ( <a href="https://www.gephebase.org/search-criteria?/and+Gene=Gephebase=eosinophil-derived+neurotoxin+(EDN)+#gephebase-summary-title">https://www.gephebase.org/search-criteria?/and+Gene=Gephebase=eosinophil-derived+neurotoxin+(EDN)+#gephebase-summary-title</a> ) |                | GP00000273 |              |
|                                                                                                                                                                                                                                                                                                             | Entry Status   | Martin     | Main curator |
| Published                                                                                                                                                                                                                                                                                                   |                |            |              |

PHENOTYPIC CHANGE

|                                                                                                                                                                                                                                                                                          |                             |                                                                                                                                                                                                                                                                                                                              |                             |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|
|                                                                                                                                                                                                                                                                                          | Trait Category              |                                                                                                                                                                                                                                                                                                                              |                             |
| Physiology ( <a href="https://www.gephebase.org/search-criteria?/and+Trait=Physiology">#Physiology</a> #gephebase-summary-title)                                                                                                                                                         |                             | Trait                                                                                                                                                                                                                                                                                                                        |                             |
| Increase in antiviral ribonuclease activity ( <a href="https://www.gephebase.org/search-criteria?/and+Trait=Increase+in+antiviral+ribonuclease+activity">#Increase in antiviral ribonuclease activity</a> #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 ( <a href="https://www.gephebase.org/search-criteria?/and+Taxonomic+Status=Intergeneric+or+Higher">#Intergeneric or Higher</a> #gephebase-summary-title)                                                                                                          |                             |                                                                                                                                                                                                                                                                                                                              |                             |
|                                                                                                                                                                                                                                                                                          | Taxon A                     |                                                                                                                                                                                                                                                                                                                              | Taxon B                     |
|                                                                                                                                                                                                                                                                                          | Latin Name                  |                                                                                                                                                                                                                                                                                                                              | Latin Name                  |
| Primates ( <a href="https://www.gephebase.org/search-criteria?/and+Taxon+and+Synonyms=Primates">#Primates</a> #gephebase-summary-title)                                                                                                                                                  |                             | Catarrhini ( <a href="https://www.gephebase.org/search-criteria?/and+Taxon+and+Synonyms=Catarrhini">#Catarrhini</a> #gephebase-summary-title)                                                                                                                                                                                |                             |
| -                                                                                                                                                                                                                                                                                        | Common Name                 | -                                                                                                                                                                                                                                                                                                                            | Common Name                 |
|                                                                                                                                                                                                                                                                                          | Synonyms                    | -                                                                                                                                                                                                                                                                                                                            | Synonyms                    |
| Primata; Primates Linnaeus, 1758                                                                                                                                                                                                                                                         |                             | -                                                                                                                                                                                                                                                                                                                            |                             |
|                                                                                                                                                                                                                                                                                          | Rank                        |                                                                                                                                                                                                                                                                                                                              | Rank                        |
| order                                                                                                                                                                                                                                                                                    |                             | parvorder                                                                                                                                                                                                                                                                                                                    |                             |
|                                                                                                                                                                                                                                                                                          | Lineage                     |                                                                                                                                                                                                                                                                                                                              | Lineage                     |
| cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Deuterostomia; Chordata; Craniata; Vertebrata; Gnathostomata; Teleostomi; Euteleostomi; Sarcopterygii; Dipnotetrapodomorpha; Tetrapoda; Amniota; Mammalia; Theria; Eutheria; Boreoeutheria; Euarchontoglires |                             | 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                      |                                                                                                                                                                                                                                                                                                                              | Parent                      |
| Euarchontoglires () - (Rank: superorder) ( <a href="https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=314146">https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=314146</a> )                                                                                         |                             | Simiiformes () - (Rank: infraorder) ( <a href="https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=314293">https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=314293</a> )                                                                                                                                  |                             |
| 9443                                                                                                                                                                                                                                                                                     | NCBI Taxonomy ID            | 9526                                                                                                                                                                                                                                                                                                                         | NCBI Taxonomy ID            |
| ( <a href="https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=9443">https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=9443</a> )                                                                                                                                      |                             | ( <a href="https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=9526">https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=9526</a> )                                                                                                                                                                          |                             |
|                                                                                                                                                                                                                                                                                          | is Taxon A an Intraspecies? |                                                                                                                                                                                                                                                                                                                              | is Taxon B an Intraspecies? |
| No                                                                                                                                                                                                                                                                                       |                             | No                                                                                                                                                                                                                                                                                                                           |                             |

GENOTYPIC CHANGE

|                                                                                                                                                                                                                                 |                         |                                                                                                                        |                         |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|------------------------------------------------------------------------------------------------------------------------|-------------------------|
|                                                                                                                                                                                                                                 | Generic Gene Name       |                                                                                                                        | UniProtKB Homo sapiens  |
| RNASE2                                                                                                                                                                                                                          |                         | P10153 ( <a href="http://www.uniprot.org/uniprot/P10153">http://www.uniprot.org/uniprot/P10153</a> )                   |                         |
|                                                                                                                                                                                                                                 | Synonyms                |                                                                                                                        | GenebankID or UniProtKB |
| EDN; RAF3; RNS2                                                                                                                                                                                                                 |                         | AAA50284 ( <a href="https://www.ncbi.nlm.nih.gov/nuccore/AAA50284">https://www.ncbi.nlm.nih.gov/nuccore/AAA50284</a> ) |                         |
|                                                                                                                                                                                                                                 | String                  |                                                                                                                        |                         |
| 9606.ENSPP00000303276 ( <a href="http://string-db.org/newstring.cgi/show_network_section.pl?identifier=9606.ENSPP00000303276">http://string-db.org/newstring.cgi/show_network_section.pl?identifier=9606.ENSPP00000303276</a> ) |                         |                                                                                                                        |                         |
|                                                                                                                                                                                                                                 | Sequence Similarities   |                                                                                                                        |                         |
| Belongs to the pancreatic ribonuclease family.                                                                                                                                                                                  |                         |                                                                                                                        |                         |
|                                                                                                                                                                                                                                 | GO - Molecular Function |                                                                                                                        |                         |
| GO:0003676 : nucleic acid binding ( <a href="https://www.ebi.ac.uk/QuickGO/term/GO:0003676">https://www.ebi.ac.uk/QuickGO/term/GO:0003676</a> )                                                                                 |                         |                                                                                                                        |                         |
| GO:0004522 : ribonuclease A activity ( <a href="https://www.ebi.ac.uk/QuickGO/term/GO:0004522">https://www.ebi.ac.uk/QuickGO/term/GO:0004522</a> )                                                                              |                         |                                                                                                                        |                         |
| GO:0004540 : ribonuclease activity ( <a href="https://www.ebi.ac.uk/QuickGO/term/GO:0004540">https://www.ebi.ac.uk/QuickGO/term/GO:0004540</a> )                                                                                |                         |                                                                                                                        |                         |
|                                                                                                                                                                                                                                 | GO - Biological Process |                                                                                                                        |                         |
| GO:0006935 : chemotaxis ( <a href="https://www.ebi.ac.uk/QuickGO/term/GO:0006935">https://www.ebi.ac.uk/QuickGO/term/GO:0006935</a> )                                                                                           |                         |                                                                                                                        |                         |

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>)

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>)

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

Nonsynonymous

Thr132Arg

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

Presumptive Null

Molecular Type

Aberration Type

SNP Coding Change

Molecular Details of the Mutation

Experimental Evidence

|            | Taxon A | Taxon B | Position |
|------------|---------|---------|----------|
| Codon      | -       | -       | -        |
| Amino-acid | -       | -       | -        |

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

Zhang J; Rosenberg HF

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.

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RELATED GEPHE

No matches found.

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](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))

Related Genes

Related Haplotypes

EXTERNAL LINKS

COMMENTS

