GEPHE SUMMARY

Gephebase Gene
CHRNA1 (https://www.gephebase.org/search-criteria?/and+Gene Gephebase=^CHRNA1^#gephebase-summary-title)

Entry Status
Published

GepheID
GP00001720

Main curator
Courtier

PHENOTYPIC CHANGE

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

Trait
Xenobiotic resistance (snake venom) (https://www.gephebase.org/search-criteria?/and+Trait=^Xenobiotic resistance (snake venom)^#gephebase-summary-title)

Trait State in Taxon A
Other Carnivora

Trait State in Taxon B
Resistance to Erabu Sea Snake (Laticauda semifasciata) - Egyptian cobra

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

Common Name
carnivores

Synonyms
carnivores

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; Laurasiatheria

Parent
Laurasiatheria () - (Rank: superorder)
(https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 314145)

NCBI Taxonomy ID
33554
(https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 33554)

is Taxon A an Infraspecies?
No

Taxon B

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

Common Name
-

Synonyms
ZMB 2820; ZMB:2820

Rank
species

Lineage
cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Deuterostomia; Chordata; Craniata; Vertebrata; Gnathostomata; Teleostomi; Euteleostomi; Sarcopterygii; Dipnotetrapodomorpha; Tetrapoda; Amniota; Sauropsida; Sauria; Lepidosauria; Squamata; Bifurcata; Unidentata; Episquamata; Toxicofera; Serpentes; Colubroidea; Elapidae; Elapinae; Naja

Parent
Naja () - (Rank: genus)
(https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 8638)

NCBI Taxonomy ID
8639
(https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 8639)

is Taxon B an Infraspecies?
No

GENOTYPIC CHANGE

Generic Gene Name
CHRNA1

Synonyms
ACHRA; ACHRD; CHRNA; CMS1A; CMS1B; CMS2A; FCCMS; SCCMS; CHNRA

String
9606.ENSP00000261007
(http://string-db.org/newstring_cgi/show_network_section.pl?identifier= 9606.ENSP00000261007)

Sequence Similarities
Belongs to the ligand-gated ion channel (TC 1.A.9) family. Acetylcholine receptor (TC 1.A.9.1) subfamily. Alpha-1/CHRNA1 sub-subfamily.

GO - Molecular Function
GO:0042166 : acetylcholine binding (https://www.ebi.ac.uk/QuickGO/term/GO:0042166)
GO:0015464 : acetylcholine receptor activity (https://www.ebi.ac.uk/QuickGO/term/GO:0015464)
GO:0022848 : acetylcholine-gated cation-selective channel activity (https://www.ebi.ac.uk/QuickGO/term/GO:0022848)

UniProtKB Homo sapiens
P02708 (http://www.uniprot.org/uniprot/P02708)

GenebankID or UniProtKB
()

GO:0005216 : ion channel activity (https://www.ebi.ac.uk/QuickGO/term/GO:0005216)
GO:1904315 : transmitter-gated ion channel activity involved in regulation of postsynaptic membrane potential (https://www.ebi.ac.uk/QuickGO/term/GO:1904315)

GO - Biological Process

GO:0007165 : signal transduction (https://www.ebi.ac.uk/QuickGO/term/GO:0007165)
GO:0007268 : chemical synaptic transmission (https://www.ebi.ac.uk/QuickGO/term/GO:0007268)
GO:0007271 : synaptic transmission, cholinergic (https://www.ebi.ac.uk/QuickGO/term/GO:0007271)
GO:0034220 : ion transmembrane transport (https://www.ebi.ac.uk/QuickGO/term/GO:0034220)
GO:0046716 : muscle cell cellular homeostasis (https://www.ebi.ac.uk/QuickGO/term/GO:0046716)
GO:0050881 : musculoskeletal movement (https://www.ebi.ac.uk/QuickGO/term/GO:0050881)
GO:0050877 : nervous system process (https://www.ebi.ac.uk/QuickGO/term/GO:0050877)
GO:0007528 : neuromuscular junction development (https://www.ebi.ac.uk/QuickGO/term/GO:0007528)
GO:0050905 : neuromuscular process (https://www.ebi.ac.uk/QuickGO/term/GO:0050905)
GO:0007274 : neuromuscular synaptic transmission (https://www.ebi.ac.uk/QuickGO/term/GO:0007274)
GO:0070050 : neuron cellular homeostasis (https://www.ebi.ac.uk/QuickGO/term/GO:0070050)
GO:0019228 : neuronal action potential (https://www.ebi.ac.uk/QuickGO/term/GO:0019228)
GO:0042391 : regulation of membrane potential (https://www.ebi.ac.uk/QuickGO/term/GO:0042391)
GO:0035094 : response to nicotine (https://www.ebi.ac.uk/QuickGO/term/GO:0035094)
GO:0003009 : skeletal muscle contraction (https://www.ebi.ac.uk/QuickGO/term/GO:0003009)
GO:0048630 : skeletal muscle tissue growth (https://www.ebi.ac.uk/QuickGO/term/GO:0048630)

GO - Cellular Component

GO:0005886 : plasma membrane (https://www.ebi.ac.uk/QuickGO/term/GO:0005886)
GO:0005887 : integral component of plasma membrane (https://www.ebi.ac.uk/QuickGO/term/GO:0005887)
GO:0030054 : cell junction (https://www.ebi.ac.uk/QuickGO/term/GO:0030054)
GO:0043005 : neuron projection (https://www.ebi.ac.uk/QuickGO/term/GO:0043005)
GO:0045211 : postsynaptic membrane (https://www.ebi.ac.uk/QuickGO/term/GO:0045211)
GO:0045202 : synapse (https://www.ebi.ac.uk/QuickGO/term/GO:0045202)
GO:0005892 : acetylcholine-gated channel complex (https://www.ebi.ac.uk/QuickGO/term/GO:0005892)
GO:0009986 : cell surface (https://www.ebi.ac.uk/QuickGO/term/GO:0009986)
GO:0099060 : integral component of postsynaptic specialization membrane (https://www.ebi.ac.uk/QuickGO/term/GO:0099060)
GO:0031594 : neuromuscular junction (https://www.ebi.ac.uk/QuickGO/term/GO:0031594)

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

Phe189Asn - The inhibitory effect on the pharmacological action of the toxin is primarily attributed to the presence of glycosylation at position N189.

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	Phe	Asn	189

Main Reference

Cobra (Naja spp.) nicotinic acetylcholine receptor exhibits resistance to Erabu sea snake (Laticauda semifasciata) short-chain alpha-neurotoxin. (2004) (https://pubmed.ncbi.nlm.nih.gov/15170255)

Authors

Takacs Z; Wilhelmsen KC; Sorota S

Abstract

Snake alpha-neutotoxins of Elapidae venoms are grouped into two structural classes, short-chain and long-chain alpha-neutotoxins. While these two classes share many chemical and biological characteristics, there are also distinct dissimilarities between them, including their binding site on the nicotinic acetylcholine receptor (nAChR), specificity among species of Chordata, and the associated pharmacological effects. In the present study we test the hypothesis that structural motifs that evolved to confer natural resistance against conspecific long-chain alpha-neurotoxins in Elapidae snakes also interfere with the biological action of short-chain alpha-neurotoxins. We expressed functional nAChRs that contains segments or single residues of the Elapidae nAChR ligand binding domain and tested the effect of short-chain alpha-neurotoxin erabutoxin-a (ETX-a) from the Erabu sea snake Laticauda semifasciata on the acetylcholine-induced currents as measured by two-microelectrode voltage clamp. Our results show that the Elapidae nAChR alpha subunit segment T(154)-L(208) ligand binding domain has an inhibitory effect on the pharmacological action of ETX-a. This effect is primarily attributed to the presence of glycosylation at position N(189). If the glycosylation is removed from the T(154)-L(208) segment, the nAChR will be inhibited, however, to a lesser extent than seen in the mouse. This effect correlates with the variations in alpha-neurotoxin sensitivity of different species and, importantly, reflects the evolutionary conservation of the binding site on the nAChR polypeptide backbone per se. Phylogenetic analysis of alpha-neurotoxin resistance suggests that alpha-neurotoxin-resistant nAChR evolved first, which permitted the evolution of snake venom alpha-neurotoxins. A model describing alpha-neurotoxin resistance in Elapidae snakes is presented.

Additional References

RELATED GEPHE

Related Genes

No matches found.

Related Haplotypes

4 (https://www.gephebase.org/search-criteria?/or+Gene Gephebase=^CHRNA1^/and+Taxon ID=^33554^/or+Gene Gephebase=^CHRNA1^/and+Taxon ID=^8639^#gephebase-summary-title)

EXTERNAL LINKS

COMMENTS