

GEPHE SUMMARY

CHRNA1 (https://www.gephebase.org/search-criteria?/and+Gene Gephebase="CHRNA1" #gephebase-summary-title)	Gephebase Gene	GP00000183	GepheID
Published	Entry Status	Courtier	Main curator

PHENOTYPIC CHANGE

Physiology (https://www.gephebase.org/search-criteria?/and+Trait Category="Physiology" #gephebase-summary-title)	Trait Category
Xenobiotic resistance (snake venom) (<a (snake="" href="https://www.gephebase.org/search-criteria?/and+Trait=" resistance="" venom)""="" xenobiotic="">https://www.gephebase.org/search-criteria?/and+Trait="Xenobiotic resistance (snake venom)" #gephebase-summary-title)	Trait
Other Carnivora	Trait State in Taxon A
Erinaceus spp.	Trait State in Taxon B
Taxon A	Ancestral State
Intergeneric or Higher (https://www.gephebase.org/search-criteria?/and+Taxonomic Status="Intergeneric or Higher" #gephebase-summary-title)	Taxonomic Status

Taxon A	Latin Name
Carnivora (https://www.gephebase.org/search-criteria?/and+Taxon and Synonyms="Carnivora" #gephebase-summary-title)	
carnivores	Common Name
carnivores	Synonyms
order	Rank
cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Deuterostomia; Chordata; Craniata; Vertebrata; Gnathostomata; Teleostomi; Euteleostomi; Sarcopterygii; Dipnotetrapodomorpha; Tetrapoda; Amniota; Mammalia; Theria; Eutheria; Boreoeutheria; Laurasiatheria	Lineage
Laurasiatheria () - (Rank: superorder) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=314145)	Parent
33554 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=33554)	NCBI Taxonomy ID
No	is Taxon A an Intraspecies?

Taxon B #1	Latin Name
Erinaceus concolor (https://www.gephebase.org/search-criteria?/and+Taxon and Synonyms="Erinaceus concolor" #gephebase-summary-title)	
southern white-breasted hedgehog	Common Name
southern white-breasted hedgehog; Erinaceus concolor Martin 1838	Synonyms
species	Rank
cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Deuterostomia; Chordata; Craniata; Vertebrata; Gnathostomata; Teleostomi; Euteleostomi; Sarcopterygii; Dipnotetrapodomorpha; Tetrapoda; Amniota; Mammalia; Theria; Eutheria; Boreoeutheria; Laurasiatheria; Eulipotyphla; Erinaceidae; Erinaceinae; Erinaceus	Lineage
Erinaceus () - (Rank: genus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=9364)	Parent
37316 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=37316)	NCBI Taxonomy ID
No	is Taxon B an Intraspecies?

Taxon B #2	Latin Name
Erinaceus europaeus (https://www.gephebase.org/search-criteria?/and+Taxon and Synonyms="Erinaceus europaeus" #gephebase-summary-title)	
western European hedgehog	Common Name
western European hedgehog; European hedgehog; common hedgehog; Erinaceus europaeus Linnaeus, 1758; Erinaceus europaeus; Erinaceus europeus	Synonyms
species	Rank
cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Deuterostomia; Chordata; Craniata; Vertebrata; Gnathostomata; Teleostomi; Euteleostomi; Sarcopterygii; Dipnotetrapodomorpha; Tetrapoda; Amniota; Mammalia; Theria; Eutheria; Boreoeutheria; Laurasiatheria; Insectivora; Erinaceidae; Erinaceinae; Erinaceus	Lineage
Erinaceus () - (Rank: genus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=9364)	Parent

9365

(https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=9365)

is Taxon B an Intraspecies?

No

GENOTYPIC CHANGE

Generic Gene Name	UniProtKB Homo sapiens
CHRNA1	P02708 (http://www.uniprot.org/uniprot/P02708)
Synonyms	GenebankID or UniProtKB
ACHRA; ACHRD; CHRNA; CMS1A; CMS1B; CMS2A; FCCMS; SCCMS; CHNRA	0
String	
9606.ENSPO0000261007 (http://string-db.org/newstring.cgi/show_network_section.pl?identifier=9606.ENSPO0000261007)	
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)	
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)	

Mutation #1

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](https://www.gephebase.org/search-criteria?/and+Molecular+Type=))

Aberration Type

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

SNP Coding Change

Nonsynonymous

Molecular Details of the Mutation

Trp187Arg

Experimental Evidence

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

	Taxon A	Taxon B	Position
Codon	-	-	-
Amino-acid	Trp	Arg	187

Main Reference

Why the honey badger don't care: Convergent evolution of venom-targeted nicotinic acetylcholine receptors in mammals that survive venomous snake bites. (2015) (<https://pubmed.ncbi.nlm.nih.gov/25796346>)

Authors

Drabeck DH; Dean AM; Jansa SA

Abstract

Honey badgers (*Mellivora capensis*) prey upon and survive bites from venomous snakes (Family: Elapidae), but the molecular basis of their venom resistance is unknown. The muscular nicotinic cholinergic receptor (nAChR), targeted by snake $\text{I}\pm$ -neurotoxins, has evolved in some venom-resistant mammals to no longer bind these toxins. Through phylogenetic analysis of mammalian nAChR sequences, we show that honey badgers, hedgehogs, and pigs have independently acquired functionally equivalent amino acid replacements in the toxin-binding site of this receptor. These convergent amino acid changes impede toxin binding by introducing a positively charged amino acid in place of an uncharged aromatic residue. In venom-resistant mongooses, different replacements at these same sites are glycosylated, which is thought to disrupt binding through steric effects. Thus, it appears that resistance to snake venom $\text{I}\pm$ -neurotoxin has evolved at least four times among mammals through two distinct biochemical mechanisms operating at the same sites on the same receptor.

Copyright © 2015 Elsevier Ltd. All rights reserved.

Additional References

Mutation #2

Presumptive Null

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

Molecular Type

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

Aberration Type

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

SNP Coding Change

Nonsynonymous

Molecular Details of the Mutation

Phe189Ile

Experimental Evidence

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

	Taxon A	Taxon B	Position
Codon	-	-	-
Amino-acid	Phe	Ile	189

Main Reference

Why the honey badger don't care: Convergent evolution of venom-targeted nicotinic acetylcholine receptors in mammals that survive venomous snake bites. (2015) (<https://pubmed.ncbi.nlm.nih.gov/25796346>)

Authors

Drabeck DH; Dean AM; Jansa SA

Abstract

Honey badgers (*Mellivora capensis*) prey upon and survive bites from venomous snakes (Family: Elapidae), but the molecular basis of their venom resistance is unknown. The muscular nicotinic cholinergic receptor (nAChR), targeted by snake $\text{I}\pm$ -neurotoxins, has evolved in some venom-resistant mammals to no longer bind these toxins. Through phylogenetic analysis of mammalian nAChR sequences, we show that honey badgers, hedgehogs, and pigs have independently acquired functionally equivalent amino acid replacements in the toxin-binding site of this receptor. These convergent amino acid changes impede toxin binding by introducing a positively charged amino acid in place of an uncharged aromatic residue. In venom-resistant mongooses, different replacements at these same sites are glycosylated, which is thought to disrupt binding through steric effects. Thus, it appears that resistance to snake venom $\text{I}\pm$ -neurotoxin has evolved at least four times among mammals through two distinct biochemical mechanisms operating at the same sites on the same receptor.

Copyright © 2015 Elsevier Ltd. All rights reserved.

Additional References

No matches found.

4 (<https://www.gephebase.org/search-criteria?/or+Gene+Gephebase=^CHRNA1^/and+Taxon+ID=^33554^/or+Gene+Gephebase=^CHRNA1^/and+Taxon+ID=^37316^/or+Gene+Gephebase=^CHRNA1^/and+Taxon+ID=^9365^#gephebase-summary-title>)

EXTERNAL LINKS

COMMENTS

Parallel changes in a 3rd lineage thought to be venom resistant (pigs)