

GEPHE SUMMARY

SCN8A (Nav1.6) (<https://www.gephebase.org/search-criteria?/and+Gene>)
 Gephebase=[^]SCN8A (Nav1.6)[^]#gephebase-summary-title

Gephebase Gene: GP00001657

Entry Status: Prigent

GepheID: Main curator

Published

PHENOTYPIC CHANGE

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

Trait Category: Physiology

Xenobiotic resistance (TTX) (<https://www.gephebase.org/search-criteria?/and+Trait>)
 Trait=[^]Xenobiotic resistance (TTX)[^]#gephebase-summary-title

Trait: Xenobiotic resistance (TTX)

Trait State in Taxon A: TTX-Sensitive *Amphiesma pryeri*

Trait State in Taxon B: TTX-Resistant natricine clade (*Afronatrix*; *Rhabdophis*; *Xenocrophis*)

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	Taxon B	Latin Name
<i>Hebius pryeri</i> (https://www.gephebase.org/search-criteria?/and+Taxon and Synonyms= [^] <i>Hebius pryeri</i> [^] #gephebase-summary-title)	Natricinae (https://www.gephebase.org/search-criteria?/and+Taxon and Synonyms= [^] Natricinae [^] #gephebase-summary-title)		
Common Name: Pryer's keelback	Common Name: -		
Synonyms: <i>Amphiesma pryeri</i> ; <i>Tropidonotus pryeri</i> ; Pryer's keelback; <i>Amphiesma pryeri</i> (Boulenger, 1887)	Synonyms: Natricidae		
Rank: species	Rank: subfamily		
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; Colubridae; Natricinae; <i>Hebius</i>	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; Colubridae		
Parent: <i>Hebius</i> () - (Rank: genus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=1591003)	Parent: Colubridae (colubrid snakes) - (Rank: family) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=8578)		NCBI Taxonomy ID: 169862
NCBI Taxonomy ID: 1159330 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=1159330)	NCBI Taxonomy ID: 169862 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=169862)		is Taxon B an Intraspecies?
No	No		is Taxon A an Intraspecies?

GENOTYPIC CHANGE

SCN8A

Generic Gene Name: A0A1B0Z7B0 (<http://www.uniprot.org/uniprot/A0A1B0Z7B0>)

Synonyms: -

String: -

Sequence Similarities: Belongs to the sodium channel (TC 1.A.1.10) family.

GO - Molecular Function: GO:0005244 : voltage-gated ion channel activity (<https://www.ebi.ac.uk/QuickGO/term/GO:0005244>)
 GO:0005248 : voltage-gated sodium channel activity (<https://www.ebi.ac.uk/QuickGO/term/GO:0005248>)

GO - Biological Process: GO:0034765 : regulation of ion transmembrane transport (<https://www.ebi.ac.uk/QuickGO/term/GO:0034765>)

UniProtKB *Afronatrix anoscopus*
 GenebankID or UniProtKB: 0

GO:0001518 : voltage-gated sodium channel complex
 (https://www.ebi.ac.uk/QuickGO/term/GO:0001518)

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

V1709I (reversion) in DIV (loss of resistance)

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	-	-	-

Main Reference

Historical Contingency in a Multigene Family Facilitates Adaptive Evolution of Toxin Resistance. (2016) (https://pubmed.ncbi.nlm.nih.gov/27291053)

Authors

McGlothlin JW; Kobiela ME; Feldman CR; Castoe TA; Geffeny SL; Hanifin CT; Toledo G; Vonk FJ; Richardson MK; Brodie ED; Pfreder ME; Brodie ED

Abstract

Novel adaptations must originate and function within an already established genome [1]. As a result, the ability of a species to adapt to new environmental challenges is predicted to be highly contingent on the evolutionary history of its lineage [2-6]. Despite a growing appreciation of the importance of historical contingency in the adaptive evolution of single proteins [7-11], we know surprisingly little about its role in shaping complex adaptations that require evolutionary change in multiple genes. One such adaptation, extreme resistance to tetrodotoxin (TTX), has arisen in several species of snakes through coevolutionary arms races with toxic amphibian prey, which select for TTX-resistant voltage-gated sodium channels (Nav) [12-16]. Here, we show that the relatively recent origins of extreme toxin resistance, which involve the skeletal muscle channel Nav1.4, were facilitated by ancient evolutionary changes in two other members of the same gene family. A substitution conferring TTX resistance to Nav1.7, a channel found in small peripheral neurons, arose in lizards ~4170 million years ago (mya) and was present in the common ancestor of all snakes. A second channel found in larger myelinated neurons, Nav1.6, subsequently evolved resistance in four different snake lineages beginning ~438 mya. Extreme TTX resistance has evolved at least five times within the past 12 million years via changes in Nav1.4, but only within lineages that previously evolved resistant Nav1.6 and Nav1.7. Our results show that adaptive protein evolution may be contingent upon enabling substitutions elsewhere in the genome, in this case, in paralogs of the same gene family.

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Additional References

RELATED GEPHE

Related Genes

1 (SCN4A (Nav1.4)) (https://www.gephebase.org/search-criteria?/or+Taxon ID=~1159330~/and+Trait=Xenobiotic resistance/or+Taxon ID=~169862~/and+Trait=Xenobiotic resistance/and+groupHaplotypes=true#gephebase-summary-title)

Related Haplotypes

No matches found.

EXTERNAL LINKS

COMMENTS

Non-null mutation