GEPHE SUMMARY

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

GepheID
GP00000770

Entry Status
Published

Main curator
Martin

PHENOTYPIC CHANGE

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

Trait
Color vision (blue shift) (https://www.gephebase.org/search-criteria?/and+Trait=^Color vision (blue shift)^#gephebase-summary-title)

Trait State in Taxon A
Other butterflies

Trait State in Taxon B
Junonia coenia; Siproeta steneles

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

Common Name
brushfoots

Synonyms
brushfoots; brush-footed butterflies

Rank
family

Lineage
cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Protostomia; Ecdysozoa; Panarthropoda; Arthropoda; Mandibulata; Pancrustacea; Hexapoda; Insecta; Dicondylia; Pterygota; Neoptera; Holometabola; Amphiesmenoptera; Lepidoptera; Glossata; Neolepidoptera; Heteroneura; Ditrysia; Obtectomera; Papilionoidea

Parent
Papilionoidea (butterflies) - (Rank: superfamily) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 37572)

NCBI Taxonomy ID
33415 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 33415)

is Taxon A an Infraspecies?
No

Taxon B

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

Common Name
buckeyes

Synonyms
buckeyes; commodores; pansies

Rank
genus

Lineage
cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Protostomia; Ecdysozoa; Panarthropoda; Arthropoda; Mandibulata; Pancrustacea; Hexapoda; Insecta; Dicondylia; Pterygota; Neoptera; Holometabola; Amphiesmenoptera; Lepidoptera; Glossata; Neolepidoptera; Heteroneura; Ditrysia; Obtectomera; Papilionoidea; Nymphalidae; Nymphalinae; Junoniini

Parent
Junoniini () - (Rank: tribe) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 311092)

NCBI Taxonomy ID
39707 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 39707)

is Taxon B an Infraspecies?
No

GENOTYPIC CHANGE

Generic Gene Name
LWRh

Synonyms
-

String
-

Sequence Similarities
Belongs to the G-protein coupled receptor 1 family. Opsin subfamily.

GO - Molecular Function
GO:0004930 : G protein-coupled receptor activity (https://www.ebi.ac.uk/QuickGO/term/GO:0004930)
GO:0009881 : photoreceptor activity (https://www.ebi.ac.uk/QuickGO/term/GO:0009881)

GO - Biological Process
GO:0018298 : protein-chromophore linkage (https://www.ebi.ac.uk/QuickGO/term/GO:0018298)
GO:0007601 : visual perception (https://www.ebi.ac.uk/QuickGO/term/GO:0007601)
GO:0007602 : phototransduction (https://www.ebi.ac.uk/QuickGO/term/GO:0007602)

UniProtKB Heliconius melpomene
E2DZP1 (http://www.uniprot.org/uniprot/E2DZP1)

GenebankID or UniProtKB
AF385332 (https://www.ncbi.nlm.nih.gov/nuccore/AF385332)

GO - Cellular Component

GO:0016021 : integral component of membrane
(https://www.ebi.ac.uk/QuickGO/term/GO:0016021)

Mutation #1

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

I17M; S137A=S180A in human LWS/MWS numbering system

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	Ile	Met	17

Main Reference

Adaptive evolution of color vision as seen through the eyes of butterflies. (2007) (https://pubmed.ncbi.nlm.nih.gov/17494749)

Authors

Frentiu FD; Bernard GD; Cuevas CI; Sison-Mangus MP; Prudic KL; Briscoe AD

Abstract

Butterflies and primates are interesting for comparative color vision studies, because both have evolved middle- (M) and long-wavelength- (L) sensitive photopigments with overlapping absorbance spectrum maxima (lambda(max) values). Although positive selection is important for the maintenance of spectral variation within the primate pigments, it remains an open question whether it contributes similarly to the diversification of butterfly pigments. To examine this issue, we performed epimicrospectrophotometry on the eyes of five Limenitis butterfly species and found a 31-nm range of variation in the lambda(max) values of the L-sensitive photopigments (514-545 nm). We cloned partial Limenitis L opsin gene sequences and found a significant excess of replacement substitutions relative to polymorphisms among species. Mapping of these L photopigment lambda(max) values onto a phylogeny revealed two instances within Lepidoptera of convergently evolved L photopigment lineages whose lambda(max) values were blue-shifted. A codon-based maximum-likelihood analysis indicated that, associated with the two blue spectral shifts, four amino acid sites (Ile17Met, Ala64Ser, Asn70Ser, and Ser137Ala) have evolved substitutions in parallel and exhibit significant d(N)/d(S) >1. Homology modeling of the full-length Limenitis arthemis astyanax L opsin placed all four substitutions within the chromophore-binding pocket. Strikingly, the Ser137Ala substitution is in the same position as a site that in primates is responsible for a 5- to 7-nm blue spectral shift. Our data show that some of the same amino acid sites are under positive selection in the photopigments of both butterflies and primates, spanning an evolutionary distance >500 million years.

Additional References

Mutation #2

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

I17M; S137A=S180A in human LWS/MWS numbering system

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	Ser	Ala	137

Main Reference

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Authors

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Additional References

RELATED GEPHE

Related Genes

1 (opsin - rhodopsin (UVRh2)) (https://www.gephebase.org/search-criteria?/or+Taxon ID=^33415^/and+Trait=Color vision/or+Taxon ID=^39707^/and+Trait=Color vision/and+groupHaplotypes=true#gephebase-summary-title)

Related Haplotypes

1 (https://www.gephebase.org/search-criteria?/or+Gene Gephebase=^opsin - rhodopsin (LWRh)^/and+Taxon ID=^33415^/or+Gene Gephebase=^opsin - rhodopsin (LWRh)^/and+Taxon ID=^39707^#gephebase-summary-title)

EXTERNAL LINKS

COMMENTS

@SeveralMutationsWithEffect