

GEPHE SUMMARY

		Gephebase Gene		GepheID
opsin - rhodopsin (LWRh) (https://www.gephebase.org/search-criteria?/and+Gene)			GP00000770	
Gephebase="opsin - rhodopsin (LWRh)"#gephebase-summary-title)				Main curator
Published		Entry Status	Martin	

PHENOTYPIC CHANGE

		Trait Category		
Physiology (https://www.gephebase.org/search-criteria?/and+Trait)				
Category="Physiology"#gephebase-summary-title)		Trait		
Color vision (blue shift) (<a color"="" href="https://www.gephebase.org/search-criteria?/and+Trait=">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		
Intergenic or Higher (https://www.gephebase.org/search-criteria?/and+Taxonomic)				
Status="Intergenic or Higher"#gephebase-summary-title)				
Taxon A		Taxon B		
	Latin Name		Latin Name	
Nymphalidae		Junonia		
(https://www.gephebase.org/search-criteria?/and+Taxon and		(https://www.gephebase.org/search-criteria?/and+Taxon and		
Synonyms="Nymphalidae"#gephebase-summary-title)		Synonyms="Junonia"#gephebase-summary-title)		
	Common Name		Common Name	
brushfoots		buckeyes		
	Synonyms		Synonyms	
brushfoots; brush-footed butterflies		buckeyes; commodores; pansies		
	Rank		Rank	
family		genus		
	Lineage		Lineage	
cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Protostomia;		cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Protostomia;		
Ecdysozoa; Panarthropoda; Arthropoda; Mandibulata; Pancrustacea; Hexapoda; Insecta;		Ecdysozoa; Panarthropoda; Arthropoda; Mandibulata; Pancrustacea; Hexapoda; Insecta;		
Dicondylia; Pterygota; Neoptera; Holometabola; Amphimesnoptera; Lepidoptera;		Dicondylia; Pterygota; Neoptera; Holometabola; Amphimesnoptera; Lepidoptera;		
Glossata; Neolepidoptera; Heteroneura; Ditrysia; Obtectomera; Papilionoidea		Glossata; Neolepidoptera; Heteroneura; Ditrysia; Obtectomera; Papilionoidea;		
	Parent		Parent	
Papilionoidea (butterflies) - (Rank: superfamily)		Nymphalidae; Nymphalinae; Junoniini		
(https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=37572)		Junoniini () - (Rank: tribe)		
	NCBI Taxonomy ID	(https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=311092)		
33415		39707		
(https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=33415)		(https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=39707)		
	is Taxon A an Intraspecies?		is Taxon B an Intraspecies?	
No		No		

GENOTYPIC CHANGE

		Generic Gene Name		UniProtKB Heliconius melpomene
LWRh		E2DZP1 (http://www.uniprot.org/uniprot/E2DZP1)		
	Synonyms		GenebankID or UniProtKB	
-		AF385332 (https://www.ncbi.nlm.nih.gov/nuccore/AF385332)		
	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)				

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

Mutation #1

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

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

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

Nonsynonymous

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

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=))

Presumptive Null

Molecular Type

Aberration Type

SNP Coding Change

Molecular Details of the Mutation

Experimental Evidence

	Taxon A	Taxon B	Position
Codon	-	-	-
Amino-acid	Ile	Met	17

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

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

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 (λ_{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 *Limnitis* butterfly species and found a 31-nm range of variation in the λ_{max} values of the L-sensitive photopigments (514-545 nm). We cloned partial *Limnitis* L opsin gene sequences and found a significant excess of replacement substitutions relative to polymorphisms among species. Mapping of these L photopigment λ_{max} values onto a phylogeny revealed two instances within Lepidoptera of convergently evolved L photopigment lineages whose λ_{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 *Limnitis 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.

Main Reference

Authors

Abstract

Additional References

Mutation #2

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

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

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

Nonsynonymous

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

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=))

Presumptive Null

Molecular Type

Aberration Type

SNP Coding Change

Molecular Details of the Mutation

Experimental Evidence

	Taxon A	Taxon B	Position
Codon	-	-	-
Amino-acid	Ser	Ala	137

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

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Authors

Abstract

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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](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