

GEPHE SUMMARY

Optix ( <a href="https://www.gephebase.org/search-criteria?/and+Gene+Gephebase+Optix+Gephebase-summary-title">https://www.gephebase.org/search-criteria?/and+Gene+Gephebase+Optix+Gephebase-summary-title</a> )	Gephebase Gene	GP00000797	GepheID
Published	Entry Status	Martin	Main curator

PHENOTYPIC CHANGE

Morphology (<https://www.gephebase.org/search-criteria?/and+Trait+Category+Morphology+Gephebase-summary-title>)

Coloration (wing, Mullerian mimicry) (<https://www.gephebase.org/search-criteria?/and+Trait+Coloration+Mullerian+mimicry+Gephebase-summary-title>)

Heliconius erato- Postman

Heliconius erato - rayed

Data not curated

Intraspecific (<https://www.gephebase.org/search-criteria?/and+Taxonomic+Status+Intraspecific+Gephebase-summary-title>)

Taxon A	Latin Name	Taxon B	Latin Name
Heliconius erato ( <a href="https://www.gephebase.org/search-criteria?/and+Taxon+Synonyms+Heliconius+erato+Gephebase-summary-title">https://www.gephebase.org/search-criteria?/and+Taxon+Synonyms+Heliconius+erato+Gephebase-summary-title</a> )	Heliconius erato ( <a href="https://www.gephebase.org/search-criteria?/and+Taxon+Synonyms+Heliconius+erato+Gephebase-summary-title">https://www.gephebase.org/search-criteria?/and+Taxon+Synonyms+Heliconius+erato+Gephebase-summary-title</a> )	Heliconius erato ( <a href="https://www.gephebase.org/search-criteria?/and+Taxon+Synonyms+Heliconius+erato+Gephebase-summary-title">https://www.gephebase.org/search-criteria?/and+Taxon+Synonyms+Heliconius+erato+Gephebase-summary-title</a> )	Heliconius erato ( <a href="https://www.gephebase.org/search-criteria?/and+Taxon+Synonyms+Heliconius+erato+Gephebase-summary-title">https://www.gephebase.org/search-criteria?/and+Taxon+Synonyms+Heliconius+erato+Gephebase-summary-title</a> )
crimson-patched longwing	crimson-patched longwing	crimson-patched longwing	crimson-patched longwing
crimson-patched longwing; Heliconius erato (Linnaeus, 1764)	crimson-patched longwing; Heliconius erato (Linnaeus, 1764)	crimson-patched longwing; Heliconius erato (Linnaeus, 1764)	crimson-patched longwing; Heliconius erato (Linnaeus, 1764)
species	species	species	species
cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Protostomia; Ecdysozoa; Panarthropoda; Arthropoda; Mandibulata; Pancrustacea; Hexapoda; Insecta; Dicondylia; Pterygota; Neoptera; Holometabola; Amphimesnoptera; Lepidoptera; Glossata; Neolepidoptera; Heteroneura; Ditrysia; Obtectomera; Papilionoidea; Nymphalidae; Heliconiinae; Heliconiini; Heliconius	cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Protostomia; Ecdysozoa; Panarthropoda; Arthropoda; Mandibulata; Pancrustacea; Hexapoda; Insecta; Dicondylia; Pterygota; Neoptera; Holometabola; Amphimesnoptera; Lepidoptera; Glossata; Neolepidoptera; Heteroneura; Ditrysia; Obtectomera; Papilionoidea; Nymphalidae; Heliconiinae; Heliconiini; Heliconius	cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Protostomia; Ecdysozoa; Panarthropoda; Arthropoda; Mandibulata; Pancrustacea; Hexapoda; Insecta; Dicondylia; Pterygota; Neoptera; Holometabola; Amphimesnoptera; Lepidoptera; Glossata; Neolepidoptera; Heteroneura; Ditrysia; Obtectomera; Papilionoidea; Nymphalidae; Heliconiinae; Heliconiini; Heliconius	cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Protostomia; Ecdysozoa; Panarthropoda; Arthropoda; Mandibulata; Pancrustacea; Hexapoda; Insecta; Dicondylia; Pterygota; Neoptera; Holometabola; Amphimesnoptera; Lepidoptera; Glossata; Neolepidoptera; Heteroneura; Ditrysia; Obtectomera; Papilionoidea; Nymphalidae; Heliconiinae; Heliconiini; Heliconius
Heliconius () - (Rank: genus) ( <a href="https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=33431">https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=33431</a> )	Heliconius () - (Rank: genus) ( <a href="https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=33431">https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=33431</a> )	Heliconius () - (Rank: genus) ( <a href="https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=33431">https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=33431</a> )	Heliconius () - (Rank: genus) ( <a href="https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=33431">https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=33431</a> )
33431 ( <a href="https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=33431">https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=33431</a> )	33431 ( <a href="https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=33431">https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=33431</a> )	33431 ( <a href="https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=33431">https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=33431</a> )	33431 ( <a href="https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=33431">https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=33431</a> )
is Taxon A an Intraspecies?	Yes	is Taxon B an Intraspecies?	Yes
Heliconius erato- Postman	Heliconius erato - rayed	Heliconius erato - rayed	Heliconius erato - rayed

GENOTYPIC CHANGE

Optix	Generic Gene Name	UniProtKB Drosophila melanogaster
anon-WO0153538.79; CG18455; D-Six3; Dmel\CG18455; Dsix3; opt; optix; OPTIX; opx; six3; Six3	Synonyms	Q95RW8 ( <a href="http://www.uniprot.org/uniprot/Q95RW8">http://www.uniprot.org/uniprot/Q95RW8</a> ) GenebankID or UniProtKB AEO13434 ( <a href="https://www.ncbi.nlm.nih.gov/nucleotide/AEO13434">https://www.ncbi.nlm.nih.gov/nucleotide/AEO13434</a> )
7227.FBpp0302920 ( <a href="http://string-db.org/newstring.cgi/show_network_section.pl?identifier=7227.FBpp0302920">http://string-db.org/newstring.cgi/show_network_section.pl?identifier=7227.FBpp0302920</a> )	String	
Belongs to the SIX/Sine oculis homeobox family.	Sequence Similarities	
GO:0043565 : sequence-specific DNA binding ( <a href="https://www.ebi.ac.uk/QuickGO/term/GO:0043565">https://www.ebi.ac.uk/QuickGO/term/GO:0043565</a> )	GO - Molecular Function	
GO:0001205 : distal enhancer DNA-binding transcription activator activity, RNA		

polymerase II-specific (<https://www.ebi.ac.uk/QuickGO/term/GO:0001205>)  
GO:0000976 : transcription regulatory region sequence-specific DNA binding  
(<https://www.ebi.ac.uk/QuickGO/term/GO:0000976>)

GO - Biological Process

GO:0045892 : negative regulation of transcription, DNA-templated

(<https://www.ebi.ac.uk/QuickGO/term/GO:0045892>)

GO:0048749 : compound eye development

(<https://www.ebi.ac.uk/QuickGO/term/GO:0048749>)

GO:0001751 : compound eye photoreceptor cell differentiation

(<https://www.ebi.ac.uk/QuickGO/term/GO:0001751>)

GO:0048856 : anatomical structure development

(<https://www.ebi.ac.uk/QuickGO/term/GO:0048856>)

GO:0001745 : compound eye morphogenesis

(<https://www.ebi.ac.uk/QuickGO/term/GO:0001745>)

GO:0048813 : dendrite morphogenesis

(<https://www.ebi.ac.uk/QuickGO/term/GO:0048813>)

GO:0007458 : progression of morphogenetic furrow involved in compound eye

morphogenesis (<https://www.ebi.ac.uk/QuickGO/term/GO:0007458>)

GO - Cellular Component

GO:0005634 : nucleus (<https://www.ebi.ac.uk/QuickGO/term/GO:0005634>)

GO:0005667 : transcription factor complex

(<https://www.ebi.ac.uk/QuickGO/term/GO:0005667>)

Presumptive Null

Unknown (<https://www.gephebase.org/search-criteria?/and+Presumptive Null=^Unknown^#gephebase-summary-title>)

Molecular Type

Cis-regulatory (<https://www.gephebase.org/search-criteria?/and+Molecular Type=^Cis-regulatory^#gephebase-summary-title>)

Aberration Type

Unknown (<https://www.gephebase.org/search-criteria?/and+Aberration Type=^Unknown^#gephebase-summary-title>)

Molecular Details of the Mutation

Not identified

Experimental Evidence

Linkage Mapping (<https://www.gephebase.org/search-criteria?/and+Experimental Evidence=^Linkage Mapping^#gephebase-summary-title>)

Main Reference

optix drives the repeated convergent evolution of butterfly wing pattern mimicry. (2011) (<https://pubmed.ncbi.nlm.nih.gov/21778360>)

Authors

Reed RD; Papa R; Martin A; Hines HM; Counterman BA; Pardo-Diaz C; Jiggins CD; Chamberlain NL; Kronforst MR; Chen R; Halder G; Nijhout HF; McMillan WO

Abstract

Mimicry--whereby warning signals in different species evolve to look similar--has long served as a paradigm of convergent evolution. Little is known, however, about the genes that underlie the evolution of mimetic phenotypes or to what extent the same or different genes drive such convergence. Here, we characterize one of the major genes responsible for mimetic wing pattern evolution in *Heliconius* butterflies. Mapping, gene expression, and population genetic work all identify a single gene, *optix*, that controls extreme red wing pattern variation across multiple species of *Heliconius*. Our results show that the cis-regulatory evolution of a single transcription factor can repeatedly drive the convergent evolution of complex color patterns in distantly related species, thus blurring the distinction between convergence and homology.

Additional References

Wing patterning gene redefines the mimetic history of *Heliconius* butterflies. (2011) (<https://pubmed.ncbi.nlm.nih.gov/22084094>)

## RELATED GEPHE

Related Genes

1 (WntA) (<https://www.gephebase.org/search-criteria?/or+Taxon ID=^33431^/and+Trait=Coloration/and+groupHaplotypes=true#gephebase-summary-title>)

Related Haplotypes

1 (<https://www.gephebase.org/search-criteria?/or+Gene Gephebase=^Optix^/and+Taxon ID=^33431^/or+Gene Gephebase=^Optix^/and+Taxon ID=^33431^#gephebase-summary-title>)

## EXTERNAL LINKS

## COMMENTS