

GEPHE SUMMARY

cortex (https://www.gephebase.org/search-criteria?/and+Gene+Gephebase=~cortex~#gephebase-summary-title)	Gephebase Gene	GP00002660	GepheID
Published	Entry Status	Courtier	Main curator

PHENOTYPIC CHANGE

Morphology (https://www.gephebase.org/search-criteria?/and+Trait+Category=~Morphology~#gephebase-summary-title)	Trait Category		
Coloration (wing) (https://www.gephebase.org/search-criteria?/and+Trait=~Coloration+(wing)~#gephebase-summary-title)	Trait		
Heliconius - absence of yellow band	Trait State in Taxon A		
Heliconius - presence of yellow band	Trait State in Taxon B		
Taxon A	Ancestral State		
Intraspecific (https://www.gephebase.org/search-criteria?/and+Taxonomic+Status=~Intraspecific~#gephebase-summary-title)	Taxonomic Status		
	Taxon A		Taxon B
Heliconius melpomene (https://www.gephebase.org/search-criteria?/and+Taxon+and+Synonyms=~Heliconius+melpomene~#gephebase-summary-title)	Latin Name	Heliconius melpomene (https://www.gephebase.org/search-criteria?/and+Taxon+and+Synonyms=~Heliconius+melpomene~#gephebase-summary-title)	Latin Name
postman butterfly	Common Name	postman butterfly	Common Name
postman butterfly; common postman; Heliconius melpomene (Linnaeus, 1758)	Synonyms	postman butterfly; common postman; Heliconius melpomene (Linnaeus, 1758)	Synonyms
species	Rank	species	Rank
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; Heliconiinae; Heliconiini; Heliconius	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; Heliconiinae; Heliconiini; Heliconius	Lineage
Heliconius () - (Rank: genus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=33416)	Parent	Heliconius () - (Rank: genus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=33416)	Parent
34740 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=34740)	NCBI Taxonomy ID	34740 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=34740)	NCBI Taxonomy ID
No	is Taxon A an Intraspecies?	No	is Taxon B an Intraspecies?

GENOTYPIC CHANGE

cort	Generic Gene Name	Q960N3 (http://www.uniprot.org/uniprot/Q960N3)	UniProtKB Drosophila melanogaster
CG11330; cor; Cort; Dmel\CG11330	Synonyms	()	GenebankID or UniProtKB
7227.FBpp0078949 (http://string-db.org/newstring.cgi/show_network_section.pl?identifier=7227.FBpp0078949)	String		
Belongs to the WD repeat CORT family.	Sequence Similarities		
GO:0010997 : anaphase-promoting complex binding (https://www.ebi.ac.uk/QuickGO/term/GO:0010997)	GO - Molecular Function		
GO:0097027 : ubiquitin-protein transferase activator activity (https://www.ebi.ac.uk/QuickGO/term/GO:0097027)			
GO:0048477 : oogenesis (https://www.ebi.ac.uk/QuickGO/term/GO:0048477)	GO - Biological Process		

GO:0045143 : homologous chromosome segregation
(<https://www.ebi.ac.uk/QuickGO/term/GO:0045143>)
GO:0031145 : anaphase-promoting complex-dependent catabolic process
(<https://www.ebi.ac.uk/QuickGO/term/GO:0031145>)
GO:0007349 : cellularization (<https://www.ebi.ac.uk/QuickGO/term/GO:0007349>)
GO:0007343 : egg activation (<https://www.ebi.ac.uk/QuickGO/term/GO:0007343>)
GO:0007144 : female meiosis I (<https://www.ebi.ac.uk/QuickGO/term/GO:0007144>)
GO:0007147 : female meiosis II (<https://www.ebi.ac.uk/QuickGO/term/GO:0007147>)
GO:0007143 : female meiotic nuclear division
(<https://www.ebi.ac.uk/QuickGO/term/GO:0007143>)
GO:0007279 : pole cell formation (<https://www.ebi.ac.uk/QuickGO/term/GO:0007279>)
GO:1905786 : positive regulation of anaphase-promoting complex-dependent catabolic
process (<https://www.ebi.ac.uk/QuickGO/term/GO:1905786>)
GO:1904668 : positive regulation of ubiquitin protein ligase activity
(<https://www.ebi.ac.uk/QuickGO/term/GO:1904668>)

GO - Cellular Component

GO:0005737 : cytoplasm (<https://www.ebi.ac.uk/QuickGO/term/GO:0005737>)

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+No^#gephebase-summary-title))

Molecular Type

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

Aberration Type

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

Insertion Size

1-10 kb

Molecular Details of the Mutation

Insertion of two transposable elements (BovB-like and Helitron-like)

Experimental Evidence

Association Mapping ([https://www.gephebase.org/search-criteria?/and+Experimental Evidence=^Association Mapping^#gephebase-summary-title](https://www.gephebase.org/search-criteria?/and+Experimental+Evidence+^Association+Mapping^#gephebase-summary-title))

Main Reference

Cortex cis-regulatory switches establish scale colour identity and pattern diversity in *Heliconius*. (2021) (<https://pubmed.ncbi.nlm.nih.gov/34280087>)

Authors

Livraghi L; Hanly JJ; Van Bellghem SM; Montejo-Kovacevich G; van der Heijden ES; Loh LS; Ren A; Warren IA; Lewis JJ; Concha C; Hebberecht L; Wright CJ; Walker JM; Foley J; Goldberg ZH; Arenas-Castro H; Salazar C; Perry MW; Papa R; Martin A; McMillan WO; Jiggins CD

Abstract

In *Heliconius* butterflies, wing colour pattern diversity and scale types are controlled by a few genes of large effect that regulate colour pattern switches between morphs and species across a large mimetic radiation. One of these genes, *cortex*, has been repeatedly associated with colour pattern evolution in butterflies. Here we carried out CRISPR knockouts in multiple *Heliconius* species and show that *cortex* is a major determinant of scale cell identity. Chromatin accessibility profiling and introgression scans identified cis-regulatory regions associated with discrete phenotypic switches. CRISPR perturbation of these regions in black hindwing genotypes recreated a yellow bar, revealing their spatially limited activity. In the *H. melpomene/timareta* lineage, the candidate CRE from yellow-barred phenotype morphs is interrupted by a transposable element, suggesting that cis-regulatory structural variation underlies these mimetic adaptations. Our work shows that *cortex* functionally controls scale colour fate and that its cis-regulatory regions control a phenotypic switch in a modular and pattern-specific fashion.

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Additional References

RELATED GEPHE

Related Genes

2 (Optix, WntA) ([https://www.gephebase.org/search-criteria?/or+Taxon ID=^34740^/and+Trait=Coloration/and+groupHaplotypes=true#gephebase-summary-title](https://www.gephebase.org/search-criteria?/or+Taxon+ID+^34740^/and+Trait+Coloration/and+groupHaplotypes=true#gephebase-summary-title))

Related Haplotypes

1 ([https://www.gephebase.org/search-criteria?/or+Gene Gephebase=^cortex^/and+Taxon ID=^34740^/or+Gene Gephebase=^cortex^/and+Taxon ID=^34740^#gephebase-summary-title](https://www.gephebase.org/search-criteria?/or+Gene+Gephebase+^cortex^/and+Taxon+ID+^34740^/or+Gene+Gephebase+^cortex^/and+Taxon+ID+^34740^#gephebase-summary-title))

EXTERNAL LINKS

COMMENTS

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