

## GEPHE SUMMARY

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

## PHENOTYPIC CHANGE

|  |                             |  |                             |
|--|-----------------------------|--|-----------------------------|
| Morphology ( <a href="https://www.gephebase.org/search-criteria?/and+Trait+Category=~Morphology~#gephebase-summary-title">https://www.gephebase.org/search-criteria?/and+Trait+Category=~Morphology~#gephebase-summary-title</a> )   | Trait Category              |  |                             |
| Coloration (wing) ( <a href="https://www.gephebase.org/search-criteria?/and+Trait=~Coloration+Coloration+Coloration~#gephebase-summary-title">https://www.gephebase.org/search-criteria?/and+Trait=~Coloration+Coloration+Coloration~#gephebase-summary-title</a> )  | 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 ( <a href="https://www.gephebase.org/search-criteria?/and+Taxonomic+Status=~Intraspecific~#gephebase-summary-title">https://www.gephebase.org/search-criteria?/and+Taxonomic+Status=~Intraspecific~#gephebase-summary-title</a> )  | Taxonomic Status            |  |                             |
|  | Taxon A                     |  | Taxon B                     |
| Heliconius melpomene ( <a href="https://www.gephebase.org/search-criteria?/and+Taxon+and+Synonyms=~Heliconius+melpomene~#gephebase-summary-title">https://www.gephebase.org/search-criteria?/and+Taxon+and+Synonyms=~Heliconius+melpomene~#gephebase-summary-title</a> )   | Latin Name                  | Heliconius melpomene ( <a href="https://www.gephebase.org/search-criteria?/and+Taxon+and+Synonyms=~Heliconius+melpomene~#gephebase-summary-title">https://www.gephebase.org/search-criteria?/and+Taxon+and+Synonyms=~Heliconius+melpomene~#gephebase-summary-title</a> )   | 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) ( <a href="https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=33416">https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=33416</a> )  | Parent                      | Heliconius () - (Rank: genus) ( <a href="https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=33416">https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=33416</a> )  | Parent                      |
| 34740 ( <a href="https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=34740">https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=34740</a> )  | NCBI Taxonomy ID            | 34740 ( <a href="https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=34740">https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=34740</a> )  | NCBI Taxonomy ID            |
| No   | is Taxon A an Intraspecies? | No   | is Taxon B an Intraspecies? |

## GENOTYPIC CHANGE

|  |                         |  |                                   |
|--|-------------------------|--|-----------------------------------|
| cort   | Generic Gene Name       | Q960N3 ( <a href="http://www.uniprot.org/uniprot/Q960N3">http://www.uniprot.org/uniprot/Q960N3</a> ) | UniProtKB Drosophila melanogaster |
| CG11330; cor; Cort; Dmel\CG11330   | Synonyms                | ()   | GenebankID or UniProtKB           |
| 7227.FBpp0078949 ( <a href="http://string-db.org/newstring.cgi/show_network_section.pl?identifier=7227.FBpp0078949">http://string-db.org/newstring.cgi/show_network_section.pl?identifier=7227.FBpp0078949</a> ) | String                  |  |                                   |
| Belongs to the WD repeat CORT family.  | Sequence Similarities   |  |                                   |
| GO:0010997 : anaphase-promoting complex binding ( <a href="https://www.ebi.ac.uk/QuickGO/term/GO:0010997">https://www.ebi.ac.uk/QuickGO/term/GO:0010997</a> )  | GO - Molecular Function |  |                                   |
| GO:0097027 : ubiquitin-protein transferase activator activity ( <a href="https://www.ebi.ac.uk/QuickGO/term/GO:0097027">https://www.ebi.ac.uk/QuickGO/term/GO:0097027</a> )                                      |                         |  |                                   |
| GO:0048477 : oogenesis ( <a href="https://www.ebi.ac.uk/QuickGO/term/GO:0048477">https://www.ebi.ac.uk/QuickGO/term/GO:0048477</a> )   | 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^#gepbase-summary-title](https://www.gephebase.org/search-criteria?/and+Presumptive+Null+No^#gepbase-summary-title))

Molecular Type

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

Aberration Type

Insertion ([https://www.gephebase.org/search-criteria?/and+Aberration Type=^Insertion^#gepbase-summary-title](https://www.gephebase.org/search-criteria?/and+Aberration+Type+^Insertion^#gepbase-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^#gepbase-summary-title](https://www.gephebase.org/search-criteria?/and+Experimental+Evidence+^Association+Mapping^#gepbase-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#gepbase-summary-title](https://www.gephebase.org/search-criteria?/or+Taxon+ID+^34740^/and+Trait+Coloration/and+groupHaplotypes=true#gepbase-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^#gepbase-summary-title](https://www.gephebase.org/search-criteria?/or+Gene+Gephebase+^cortex^/and+Taxon+ID+^34740^/or+Gene+Gephebase+^cortex^/and+Taxon+ID+^34740^#gepbase-summary-title))

## EXTERNAL LINKS

## COMMENTS

@Parallelism @TE