GEPHE SUMMARY

Gephebase Gene
cytochrome c oxidase (COX7A) (https://www.gephebase.org/search-criteria?/and+Gene Gephebase=^cytochrome c oxidase (COX7A)^#gephebase-summary-title)

GepheID
GP00001980

Entry Status
Published

Main curator
Courtier

PHENOTYPIC CHANGE

Trait #1

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

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

Trait State in Taxon A
other Drosophila simulans

Trait State in Taxon B
Drosophila simulans homozygous for the deletion - reduction in cox activity - compensated by an increase in mtDNA copy number and ADP:O ratio that is correlated with higher early fertility - reduced physical activity in homozygotes on day 18 and reduced mean survival

Trait #2

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

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

Trait State in Taxon A
Drosophila simulans

Trait State in Taxon B
Drosophila simulans - reduction in cox activity - compensated by an increase in mtDNA copy number and ADP:O ratio that is correlated with higher early fertility - reduced physical activity in homozygotes on day 18 and reduced mean survival

Trait #3

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

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

Trait State in Taxon A
Drosophila simulans

Trait State in Taxon B
Drosophila simulans - reduction in cox activity - compensated by an increase in mtDNA copy number and ADP:O ratio that is correlated with higher early fertility - reduced physical activity in homozygotes on day 18 and reduced mean survival

Ancestral State
Taxon A

Taxonomic Status
Intraspecific (https://www.gephebase.org/search-criteria?/and+Taxonomic Status=^Intraspecific^#gephebase-summary-title)

Taxon A

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

Common Name
-

Synonyms
-

Taxon B

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

Common Name
-

Synonyms
-

Rank

species

Lineage

cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Protostomia; Ecdysozoa; Panarthropoda; Arthropoda; Mandibulata; Pancrustacea; Hexapoda; Insecta; Dicondylia; Pterygota; Neoptera; Holometabola; Diptera; Brachycera; Muscomorpha; Eremoneura; Cyclorrhapha; Schizophora; Acalyptratae; Ephydroidea; Drosophilidae; Drosophilinae; Drosophilini; Drosophila; Sophophora; melanogaster group; melanogaster subgroup

Parent

melanogaster subgroup () - (Rank: species subgroup) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 32351)

NCBI Taxonomy ID

7240 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 7240)

is Taxon A an Infraspecies?

No

Rank

species

Lineage

cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Protostomia; Ecdysozoa; Panarthropoda; Arthropoda; Mandibulata; Pancrustacea; Hexapoda; Insecta; Dicondylia; Pterygota; Neoptera; Holometabola; Diptera; Brachycera; Muscomorpha; Eremoneura; Cyclorrhapha; Schizophora; Acalyptratae; Ephydroidea; Drosophilidae; Drosophilinae; Drosophilini; Drosophila; Sophophora; melanogaster group; melanogaster subgroup

Parent

melanogaster subgroup () - (Rank: species subgroup) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 32351)

NCBI Taxonomy ID

7240 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 7240)

is Taxon B an Infraspecies?

No

GENOTYPIC CHANGE

Generic Gene Name

COX7A

Synonyms

CG9603; Cox7a; COXJ; COXK; Dmel\CG9603; VIIa

String

7227.FBpp0296960 (http://string-db.org/newstring_cgi/show_network_section.pl?identifier= 7227.FBpp0296960)

Sequence Similarities

Belongs to the cytochrome c oxidase VIIa family.

GO - Molecular Function

GO:0004129 : cytochrome-c oxidase activity (https://www.ebi.ac.uk/QuickGO/term/GO:0004129)

GO - Biological Process

GO:0006123 : mitochondrial electron transport, cytochrome c to oxygen (https://www.ebi.ac.uk/QuickGO/term/GO:0006123)
GO:0097250 : mitochondrial respirasome assembly (https://www.ebi.ac.uk/QuickGO/term/GO:0097250)
GO:0002082 : regulation of oxidative phosphorylation (https://www.ebi.ac.uk/QuickGO/term/GO:0002082)

GO - Cellular Component

GO:0005739 : mitochondrion (https://www.ebi.ac.uk/QuickGO/term/GO:0005739)
GO:0005751 : mitochondrial respiratory chain complex IV (https://www.ebi.ac.uk/QuickGO/term/GO:0005751)

UniProtKB Drosophila melanogaster

Q9VHS2 (http://www.uniprot.org/uniprot/Q9VHS2)

GenebankID or UniProtKB

()

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

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

Deletion Size

1-9 bp

Molecular Details of the Mutation

Deletion of two amino acids (Trp85 and Val86). The deletion occurs in subunit 7A of the mitochondrial electron trans-port chain protein cytochrome c oxidase (cox7A). The nuclear encoded cox7A gene produces a protein that isimported into the mitochondrion and forms a subunit of complexIV (cytochrome c oxidase) of the electron transport chain.

Experimental Evidence

Candidate Gene (https://www.gephebase.org/search-criteria?/and+Experimental Evidence=^Candidate Gene^#gephebase-summary-title)

Main Reference

A candidate complex approach to study functional mitochondrial DNA changes: sequence variation and quaternary structure modeling of Drosophila simulans cytochrome c oxidase. (2008) (https://pubmed.ncbi.nlm.nih.gov/18320260)

Authors

Melvin RG; Katewa SD; Ballard JW

Abstract

A problem with studying evolutionary dynamics of mitochondrial (mt) DNA is that classical population genetic techniques cannot identify selected substitutions because of genetic hitchhiking. We circumvented this problem by employing a candidate complex approach to study sequence variation in cytochrome c oxidase (COX) genes within and among three distinct Drosophila simulans mtDNA haplogroups. First, we determined sequence variation in complete coding regions for all COX mtDNA and nuclear loci and their isoforms. Second, we constructed a quaternary structure model of D. simulans COX. Third, we predicted that six of nine amino acid changes in D. simulans mtDNA are likely to be functionally important. Of these seven, genetic crosses can experimentally determine the functional significance of three. Fourth, we identified two single amino acid changes and a deletion of two consecutive amino acids in nuclear encoded COX loci that are likely to influence cytochrome c oxidase activity. These data show that linking population genetics and quaternary structure modeling can lead to functional predictions of specific mtDNA amino acid mutations and validate the candidate complex approach.

Additional References

Early life benefits and later life costs of a two amino acid deletion in Drosophila simulans. (2011) (https://pubmed.ncbi.nlm.nih.gov/21143473)

RELATED GEPHE

Related Genes

1 (InR) (https://www.gephebase.org/search-criteria?/or+Taxon ID=^7240^/and+Trait=Fertility/or+Taxon ID=^7240^/and+Trait=Lifespan/or+Taxon ID=^7240^/and+Trait=Locomotor activity/and+groupHaplotypes=true#gephebase-summary-title)

Related Haplotypes

No matches found.

EXTERNAL LINKS

COMMENTS

http://flybase.org/reports/FBal0277773