GEPHE SUMMARY

Gephebase Gene

Or22a (https://www.gephebase.org/search-criteria?/and+Gene Gephebase=^Or22a^#gephebase-summary-title)

GepheID

GP00002183

Entry Status

Published

Main curator

Courtier

PHENOTYPIC CHANGE

Trait Category

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

Trait

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

Trait State in Taxon A

response to noni odor

Trait State in Taxon B

no response to noni odor

Ancestral State

Taxon A

Taxonomic Status

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

Taxon A

Latin Name

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

Common Name

fruit fly

Synonyms

Sophophora melanogaster; fruit fly; Drosophila melanogaster Meigen, 1830; Sophophora melanogaster (Meigen, 1830); Drosophila melangaster

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

7227 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 7227)

is Taxon A an Infraspecies?

No

Taxon B #1

Latin Name

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

Common Name

-

Synonyms

Drosophila sechellia Tsacas and Bachli, 1981

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

7238 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 7238)

is Taxon B an Infraspecies?

No

Taxon B #2

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 B an Infraspecies?

No

Taxon B #3

Latin Name

Drosophila mauritiana (https://www.gephebase.org/search-criteria?/and+Taxon and Synonyms=^Drosophila mauritiana^#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

7226

(https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 7226)

is Taxon B an Infraspecies?

No

GENOTYPIC CHANGE

Generic Gene Name

Or22a

Synonyms

22a; 22A.1; AN11; CG12193; Dmel Or22a; Dmel22a; Dmel\CG12193; DmOr22a; dOr22a; DOR22a; DOR22A.1; dor53; Dor53; DOR53; Or22; OR22a; Or22A.1; Or22a/b; Or53

String

7227.FBpp0077541

(http://string-db.org/newstring_cgi/show_network_section.pl?identifier= 7227.FBpp0077541)

Sequence Similarities

Belongs to the insect chemoreceptor superfamily. Heteromeric odorant receptor channel (TC 1.A.69) family. Or2a subfamily.

GO - Molecular Function

GO:0004888 : transmembrane signaling receptor activity (https://www.ebi.ac.uk/QuickGO/term/GO:0004888)
GO:0005549 : odorant binding (https://www.ebi.ac.uk/QuickGO/term/GO:0005549)
GO:0004984 : olfactory receptor activity (https://www.ebi.ac.uk/QuickGO/term/GO:0004984)

GO - Biological Process

GO:0007165 : signal transduction (https://www.ebi.ac.uk/QuickGO/term/GO:0007165)
GO:0042048 : olfactory behavior (https://www.ebi.ac.uk/QuickGO/term/GO:0042048)
GO:0007608 : sensory perception of smell (https://www.ebi.ac.uk/QuickGO/term/GO:0007608)
GO:0050911 : detection of chemical stimulus involved in sensory perception of smell (https://www.ebi.ac.uk/QuickGO/term/GO:0050911)

GO - Cellular Component

GO:0016021 : integral component of membrane (https://www.ebi.ac.uk/QuickGO/term/GO:0016021)
GO:0005886 : plasma membrane (https://www.ebi.ac.uk/QuickGO/term/GO:0005886)
GO:0030425 : dendrite (https://www.ebi.ac.uk/QuickGO/term/GO:0030425)
GO:0032590 : dendrite membrane (https://www.ebi.ac.uk/QuickGO/term/GO:0032590)
GO:0071683 : sensory dendrite (https://www.ebi.ac.uk/QuickGO/term/GO:0071683)

UniProtKB Drosophila melanogaster

P81909 (http://www.uniprot.org/uniprot/P81909)

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

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

SNP Coding Change

Nonsynonymous

Molecular Details of the Mutation

Effect of the mutation tested in a Or22a construct which rescues the Or22a knock-down mutation in D. melanogaster.There are two other amino acid changes that may have an effect as well.

Experimental Evidence

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

	Taxon A	Taxon B	Position
Codon	-	-	-
Amino-acid	Ile	Met	93

Main Reference

Olfactory receptor and circuit evolution promote host specialization. (2020) (https://pubmed.ncbi.nlm.nih.gov/32132713)

Authors

Auer TO; Khallaf MA; Silbering AF; Zappia G; Ellis K; Ãlvarez-OcaÃ±a R; Arguello JR; Hansson BS; Jefferis GSXE; Caron SJC; Knaden M; Benton R

Abstract

The evolution of animal behaviour is poorly understood. Despite numerous correlations between interspecific divergence in behaviour and nervous system structure and function, demonstrations of the genetic basis of these behavioural differences remain rare. Here we develop a neurogenetic model, Drosophila sechellia, a species that displays marked differences in behaviour compared to its close cousin Drosophila melanogaster, which are linked to its extreme specialization on noni fruit (Morinda citrifolia). Using calcium imaging, we identify olfactory pathways in D.Â sechellia that detect volatiles emitted by theÂ noni host. Our mutational analysis indicates roles for different olfactory receptors in long- and short-range attraction to noni, and our cross-species allele-transfer experiments demonstrate that the tuning of one of these receptors is important for species-specific host-seeking. We identify the molecular determinants of this functional change, and characterize their evolutionary origin and behavioural importance. We perform circuit tracing in the D.Â sechellia brain, and find that receptor adaptations are accompanied by increased sensory pooling onto interneurons as well as species-specific central projection patterns. This work reveals an accumulation of molecular, physiological and anatomical traits that are linked to behavioural divergence between species, and defines a model for investigatingÂ speciation and the evolution of the nervous system.

Additional References

RELATED GEPHE

Related Genes

2 (Ir75a, Ir75b) (https://www.gephebase.org/search-criteria?/or+Taxon ID=^7227^/and+Trait=Olfaction/or+Taxon ID=^7238^/and+Trait=Olfaction/or+Taxon ID=^7240^/and+Trait=Olfaction/or+Taxon ID=^7226^/and+Trait=Olfaction/and+groupHaplotypes=true#gephebase-summary-title)

Related Haplotypes

No matches found.

EXTERNAL LINKS

COMMENTS