

GEPHE SUMMARY

|   |                |            |              |
|---|----------------|------------|--------------|
| Or22a ( <a href="https://www.gephebase.org/search-criteria?/and+Gene">https://www.gephebase.org/search-criteria?/and+Gene</a><br>Gephebase="Or22a"#gephebase-summary-title) | Gephebase Gene | GP00002183 | GepheID      |
| Published   | Entry Status   | Courtier   | Main curator |

PHENOTYPIC CHANGE

|   |                        |
|---|------------------------|
| Physiology ( <a href="https://www.gephebase.org/search-criteria?/and+Trait">https://www.gephebase.org/search-criteria?/and+Trait</a><br>Category="Physiology"#gephebase-summary-title)                            | Trait Category         |
| Olfaction ( <a href="https://www.gephebase.org/search-criteria?/and+Trait=" olfaction"#gephebase-summary-title"="">https://www.gephebase.org/search-criteria?/and+Trait="Olfaction"#gephebase-summary-title</a> ) | Trait                  |
| response to noni odor   | Trait State in Taxon A |
| no response to noni odor  | Trait State in Taxon B |
| Taxon A   | Ancestral State        |
| Interspecific ( <a href="https://www.gephebase.org/search-criteria?/and+Taxonomic">https://www.gephebase.org/search-criteria?/and+Taxonomic</a><br>Status="Interspecific"#gephebase-summary-title)                | Taxonomic Status       |

| Taxon A  | Latin Name | Common Name | Synonyms   | Rank    | Lineage   | Parent   | NCBI Taxonomy ID  | is Taxon A an Intraspecies? |
|--|------------|-------------|--|---------|---|--|---|-----------------------------|
| Drosophila melanogaster<br>( <a drosophila+melanogaster"#gephebase-summary-title"="" href="https://www.gephebase.org/search-criteria?/and+Taxon+and+Synonyms=">https://www.gephebase.org/search-criteria?/and+Taxon+and+Synonyms="Drosophila+melanogaster"#gephebase-summary-title</a> ) |            | fruit fly   | Sophophora melanogaster; fruit fly; Drosophila melanogaster Meigen, 1830; Sophophora melanogaster (Meigen, 1830); Drosophila melangaster | species | 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 | melanogaster subgroup () - (Rank: species subgroup)<br>( <a href="https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=32351">https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=32351</a> ) | 7227<br>( <a href="https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=7227">https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=7227</a> ) | No                          |

| Taxon B #1  | Latin Name | Common Name | Synonyms                                     | Rank    | Lineage   | Parent   | NCBI Taxonomy ID  | is Taxon B an Intraspecies? |
|---|------------|-------------|--|---------|---|--|---|-----------------------------|
| Drosophila sechellia<br>( <a drosophila+sechellia"#gephebase-summary-title"="" href="https://www.gephebase.org/search-criteria?/and+Taxon+and+Synonyms=">https://www.gephebase.org/search-criteria?/and+Taxon+and+Synonyms="Drosophila+sechellia"#gephebase-summary-title</a> ) |            | -           | Drosophila sechellia Tsacas and Bachli, 1981 | species | 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 | melanogaster subgroup () - (Rank: species subgroup)<br>( <a href="https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=32351">https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=32351</a> ) | 7238<br>( <a href="https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=7238">https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=7238</a> ) | No                          |

| Taxon B #2   | Latin Name | Common Name | Synonyms | Rank    | Lineage   | Parent  |
|--|------------|-------------|----------|---------|---|---|
| Drosophila simulans<br>( <a drosophila+simulans"#gephebase-summary-title"="" href="https://www.gephebase.org/search-criteria?/and+Taxon+and+Synonyms=">https://www.gephebase.org/search-criteria?/and+Taxon+and+Synonyms="Drosophila+simulans"#gephebase-summary-title</a> ) |            | -           | -        | species | 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 | 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 Intraspecies?  
 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 Intraspecies?  
 No

GENOTYPIC CHANGE

|  |   |  |
|--|---|--|
| <p>Or22a</p> <p>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</p> <p>7227.FBpp0077541<br/>       (<a href="http://string-db.org/newstring.cgi/show_network_section.pl?identifier=7227.FBpp0077541">http://string-db.org/newstring.cgi/show_network_section.pl?identifier=7227.FBpp0077541</a>)</p> <p>Sequence Similarities</p> <p>Belongs to the insect chemoreceptor superfamily. Heteromeric odorant receptor channel (TC 1.A.69) family. Or2a subfamily.</p> <p>GO - Molecular Function</p> <p>GO:0004888 : transmembrane signaling receptor activity<br/>       (<a href="https://www.ebi.ac.uk/QuickGO/term/GO:0004888">https://www.ebi.ac.uk/QuickGO/term/GO:0004888</a>)<br/>       GO:0005549 : odorant binding (<a href="https://www.ebi.ac.uk/QuickGO/term/GO:0005549">https://www.ebi.ac.uk/QuickGO/term/GO:0005549</a>)<br/>       GO:0004984 : olfactory receptor activity<br/>       (<a href="https://www.ebi.ac.uk/QuickGO/term/GO:0004984">https://www.ebi.ac.uk/QuickGO/term/GO:0004984</a>)</p> <p>GO - Biological Process</p> <p>GO:0007165 : signal transduction (<a href="https://www.ebi.ac.uk/QuickGO/term/GO:0007165">https://www.ebi.ac.uk/QuickGO/term/GO:0007165</a>)<br/>       GO:0042048 : olfactory behavior (<a href="https://www.ebi.ac.uk/QuickGO/term/GO:0042048">https://www.ebi.ac.uk/QuickGO/term/GO:0042048</a>)<br/>       GO:0007608 : sensory perception of smell<br/>       (<a href="https://www.ebi.ac.uk/QuickGO/term/GO:0007608">https://www.ebi.ac.uk/QuickGO/term/GO:0007608</a>)<br/>       GO:0050911 : detection of chemical stimulus involved in sensory perception of smell<br/>       (<a href="https://www.ebi.ac.uk/QuickGO/term/GO:0050911">https://www.ebi.ac.uk/QuickGO/term/GO:0050911</a>)</p> <p>GO - Cellular Component</p> <p>GO:0016021 : integral component of membrane<br/>       (<a href="https://www.ebi.ac.uk/QuickGO/term/GO:0016021">https://www.ebi.ac.uk/QuickGO/term/GO:0016021</a>)<br/>       GO:0005886 : plasma membrane (<a href="https://www.ebi.ac.uk/QuickGO/term/GO:0005886">https://www.ebi.ac.uk/QuickGO/term/GO:0005886</a>)<br/>       GO:0030425 : dendrite (<a href="https://www.ebi.ac.uk/QuickGO/term/GO:0030425">https://www.ebi.ac.uk/QuickGO/term/GO:0030425</a>)<br/>       GO:0032590 : dendrite membrane (<a href="https://www.ebi.ac.uk/QuickGO/term/GO:0032590">https://www.ebi.ac.uk/QuickGO/term/GO:0032590</a>)<br/>       GO:0071683 : sensory dendrite (<a href="https://www.ebi.ac.uk/QuickGO/term/GO:0071683">https://www.ebi.ac.uk/QuickGO/term/GO:0071683</a>)</p> <p>No (<a href="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</a>)</p> <p>Coding (<a href="https://www.gephebase.org/search-criteria?/and+Molecular Type=Coding#gephebase-summary-title">https://www.gephebase.org/search-criteria?/and+Molecular Type=Coding#gephebase-summary-title</a>)</p> <p>SNP (<a href="https://www.gephebase.org/search-criteria?/and+Aberration Type=SNP#gephebase-summary-title">https://www.gephebase.org/search-criteria?/and+Aberration Type=SNP#gephebase-summary-title</a>)</p> | <p>Generic Gene Name</p> <p>Synonyms</p> <p>String</p> <p>GO - Molecular Function</p> <p>GO - Biological Process</p> <p>GO - Cellular Component</p> | <p>UniProtKB Drosophila melanogaster<br/>       P81909 (<a href="http://www.uniprot.org/uniprot/P81909">http://www.uniprot.org/uniprot/P81909</a>)</p> <p>GenebankID or UniProtKB</p> <p>Presumptive Null</p> <p>Molecular Type</p> <p>Aberration Type</p> |
|--|---|--|

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; Álvarez-Ocaña 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. sechellia* that detect volatiles emitted by the 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. 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 investigating speciation and the evolution of the nervous system.

Additional References

## RELATED GEPHE

Related Genes

2 (lr75a, lr75b) (<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