

## GEPHE SUMMARY

**Gephebase Gene**  
Acetylcholinesterase (Ace)

**Entry Status**  
Published

**GepheID**  
GP00000041

**Main curator**  
Martin

## PHENOTYPIC CHANGE

**Trait Category**  
Physiology

**Trait**  
Xenobiotic resistance (insecticide)

**Trait State in Taxon A**  
Musca domestica - sensitive

**Trait State in Taxon B**  
Musca domestica- resistant 690ab

**Ancestral State**  
Taxon A

**Taxonomic Status**  
Intraspecific

### Taxon A

**Latin Name**  
*Musca domestica*

**Common Name**  
house fly

**Synonyms**  
house fly; Musca domestica Linnaeus, 1758

**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; Calyptratae; Muscoidea; Muscidae; Muscinae; Muscini; Musca; Musca

**Parent**  
Musca () - (Rank: subgenus)

**NCBI Taxonomy ID**  
7370

**is Taxon A an Intraspecies?**  
No

### Taxon B

**Latin Name**  
*Musca domestica*

**Common Name**  
house fly

**Synonyms**  
house fly; Musca domestica Linnaeus, 1758

**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; Calyptratae; Muscoidea; Muscidae; Muscinae; Muscini; Musca; Musca

**Parent**  
Musca () - (Rank: subgenus)

**NCBI Taxonomy ID**  
7370

**is Taxon B an Intraspecies?**  
Yes

**Taxon B Description**  
Musca domestica- resistant 690ab

## GENOTYPIC CHANGE

**Generic Gene Name**  
Ace

**Synonyms**  
AcChE; ace; ACE; ace-2; ache; AchE; AChE; CG17907; CHE; dAChE; dmAChE; DmAChE; Dmel\CG17907; Dm\_ace; FBgn0000024; l(3)26; l(3)87Ed

**String**  
7227.FBpp0289713

**Sequence Similarities**  
Belongs to the type-B carboxylesterase/lipase family.

**GO - Molecular Function**  
GO:0042803 : protein homodimerization activity  
GO:0003990 : acetylcholinesterase activity  
GO:0004104 : cholinesterase activity  
GO:0043199 : sulfate binding

**GO - Biological Process**  
GO:0006581 : acetylcholine catabolic process

**UniProtKB Drosophila melanogaster**  
P07140

**GenebankID or UniProtKB**  
ACM68725

GO:0001507 : acetylcholine catabolic process in synaptic cleft  
GO:0007268 : chemical synaptic transmission  
GO:0042426 : choline catabolic process  
GO:0042331 : phototaxis

GO - Cellular Component  
GO:0005886 : plasma membrane  
GO:0005737 : cytoplasm  
GO:0031225 : anchored component of membrane  
GO:0030054 : cell junction  
GO:0043083 : synaptic cleft

Presumptive Null  
No

Molecular Type  
Coding

Aberration Type  
SNP

SNP Coding Change  
Nonsynonymous

Molecular Details of the Mutation  
Gly262Val

Experimental Evidence  
Candidate Gene

	Taxon A	Taxon B	Position
Codon	-	-	-
Amino-acid	-	-	-

Main Reference  
Identification and characterization of mutations in housefly (*Musca domestica*) acetylcholinesterase involved in insecticide resistance. (2001)

Authors  
Walsh SB; Dolden TA; Moores GD; Kristensen M; Lewis T; Devonshire AL; Williamson MS

Abstract  
Acetylcholinesterase (AChE) insensitive to organophosphate and carbamate insecticides has been identified as a major resistance mechanism in numerous arthropod species. However, the associated genetic changes have been reported in the AChE genes from only three insect species; their role in conferring insecticide insensitivity has been confirmed, using functional expression, only for those in *Drosophila melanogaster*. The housefly, *Musca domestica*, was one of the first insects shown to have this mechanism; here we report the occurrence of five mutations (Val-180-->Leu, Gly-262-->Ala, Gly-262-->Val, Phe-327-->Tyr and Gly-365-->Ala) in the AChE gene of this species that, either singly or in combination, confer different spectra of insecticide resistance. The baculovirus expression of wild-type and mutated housefly AChE proteins has confirmed that the mutations each confer relatively modest levels of insecticide insensitivity except the novel Gly-262-->Val mutation, which results in much stronger resistance (up to 100-fold) to certain compounds. In all cases the effects of mutation combinations are additive. The mutations introduce amino acid substitutions that are larger than the corresponding wild-type residues and are located within the active site of the enzyme, close to the catalytic triad. The likely influence of these substitutions on the accessibility of the different types of inhibitor and the orientation of key catalytic residues are discussed in the light of the three-dimensional structures of the AChE protein from *Torpedo californica* and *D. melanogaster*.

Additional References

## RELATED GEPHE

Related Genes  
4 (CYP6D1, esterase isozyme E7 = E3, para (kdr), resistance to dieldrin)  
Related Haplotypes  
4

## EXTERNAL LINKS

## COMMENTS

