

Acetylcholinesterase (Ace-2) (https://www.gephebase.org/search-criteria?/and+Gene)	Gephebase Gene	GepelD
Gephebase="Acetylcholinesterase (Ace-2)" #gephebase-summary-title)	GP00002582	Main curator
Published	Entry Status	Courtier

Physiology (https://www.gephebase.org/search-criteria?/and+Trait+Category=~Physiology~#gephebase-summary-title)		Trait Category	
Xenobiotic resistance (insecticide) (https://www.gephebase.org/search-criteria?/and+Trait=~Xenobiotic resistance (insecticide)~#gephebase-summary-title)		Trait	
Musca domestica - sensitive		Trait State in Taxon A	
Musca domestica- resistant 77M; CH2		Trait State in Taxon B	
Taxon A		Ancestral State	
Intraspecific (https://www.gephebase.org/search-criteria?/and+Taxonomic+Status=~Intraspecific~#gephebase-summary-title)		Taxonomic Status	
Taxon A		Taxon B	
Musca domestica (https://www.gephebase.org/search-criteria?/and+Taxon and Synonyms=~Musca domestica~#gephebase-summary-title)		Musca domestica (https://www.gephebase.org/search-criteria?/and+Taxon and Synonyms=~Musca domestica~#gephebase-summary-title)	
house fly		house fly	
house fly; Musca domestica Linnaeus, 1758		house fly; Musca domestica Linnaeus, 1758	
species		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; Calypttratae; Muscoidea; Muscidae; Muscinae; Muscini; Musca; Musca		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; Calypttratae; Muscoidea; Muscidae; Muscinae; Muscini; Musca; Musca	
Musca () - (Rank: subgenus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=44052)		Musca () - (Rank: subgenus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=44052)	
7370 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=7370)		7370 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=7370)	
is Taxon A an Intraspecies?		is Taxon B an Intraspecies?	
No		Yes	
		Taxon B Description	
		Musca domestica- resistant 77M; CH2	

Generic Gene Name		UniProtKB Drosophila melanogaster
Ace		P07140 (http://www.uniprot.org/uniprot/P07140)
Synonyms		GenebankID or UniProtKB
AcChE; ace; ACE; ace-2; ache; AchE; AChE; CG17907; CHE; dAChE; dmAChE; DmAChE; Dmel\CG17907; Dm_ace; FBgn0000024; l(3)26; l(3)87Ed		ACM68725 (https://www.ncbi.nlm.nih.gov/nucore/ACM68725)
String		
7227.FBpp0289713 (http://string-db.org/newstring.cgi/show_network_section.pl?identifier=7227.FBpp0289713)		
Sequence Similarities		
Belongs to the type-B carboxylesterase/lipase family.		
GO - Molecular Function		
GO:0042803 : protein homodimerization activity (https://www.ebi.ac.uk/QuickGO/term/GO:0042803)		
GO:0003990 : acetylcholinesterase activity		

(<https://www.ebi.ac.uk/QuickGO/term/GO:0003990>)
GO:0004104 : cholinesterase activity (<https://www.ebi.ac.uk/QuickGO/term/GO:0004104>)
GO:0043199 : sulfate binding (<https://www.ebi.ac.uk/QuickGO/term/GO:0043199>)
GO - Biological Process

GO:0006581 : acetylcholine catabolic process
(<https://www.ebi.ac.uk/QuickGO/term/GO:0006581>)
GO:0001507 : acetylcholine catabolic process in synaptic cleft
(<https://www.ebi.ac.uk/QuickGO/term/GO:0001507>)
GO:0007268 : chemical synaptic transmission
(<https://www.ebi.ac.uk/QuickGO/term/GO:0007268>)
GO:0042426 : choline catabolic process
(<https://www.ebi.ac.uk/QuickGO/term/GO:0042426>)
GO:0042331 : phototaxis (<https://www.ebi.ac.uk/QuickGO/term/GO:0042331>)

GO - Cellular Component

GO:0005886 : plasma membrane (<https://www.ebi.ac.uk/QuickGO/term/GO:0005886>)
GO:0005737 : cytoplasm (<https://www.ebi.ac.uk/QuickGO/term/GO:0005737>)
GO:0031225 : anchored component of membrane
(<https://www.ebi.ac.uk/QuickGO/term/GO:0031225>)
GO:0030054 : cell junction (<https://www.ebi.ac.uk/QuickGO/term/GO:0030054>)
GO:0043083 : synaptic cleft (<https://www.ebi.ac.uk/QuickGO/term/GO:0043083>)

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

F290Y

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	Phe	Tyr	290

Main Reference

Identification and characterization of mutations in housefly (*Musca domestica*) acetylcholinesterase involved in insecticide resistance. (2001) (<https://pubmed.ncbi.nlm.nih.gov/11563981>)

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

Genotype to phenotype, the molecular and physiological dimensions of resistance in arthropods. (2015) (<https://pubmed.ncbi.nlm.nih.gov/26047113>)

RELATED GEPHE

Related Genes

5 (Acetylcholinesterase (Ace), CYP6D1, esterase isozyme E7 = E3, para (kdr), resistance to dieldrin) (<https://www.gephebase.org/search-criteria?/or+Taxon ID=~7370~and+Trait=Xenobiotic resistance/and+groupHaplotypes=true#gephebase-summary-title>)

Related Haplotypes

4 ([https://www.gephebase.org/search-criteria?/or+Gene Gephebase=~Acetylcholinesterase \(Ace-2\)~/and+Taxon ID=~7370~/or+Gene Gephebase=~Acetylcholinesterase \(Ace-2\)~/and+Taxon ID=~7370~#gephebase-summary-title](https://www.gephebase.org/search-criteria?/or+Gene Gephebase=~Acetylcholinesterase (Ace-2)~/and+Taxon ID=~7370~/or+Gene Gephebase=~Acetylcholinesterase (Ace-2)~/and+Taxon ID=~7370~#gephebase-summary-title))

EXTERNAL LINKS

