



# Activity studies of Perfumes and Deodorants on the Genome of *Drosophila* species

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**Abstract:** *Drosophila* species represent an excellent model for investigating the genetic basis of phenotypic variation for olfactory behavior. The analysis of genetics of behavior within and between species provides important clues about the forces shaping the evolution of behavioral genes. Olfactory sense is, in terms of evolution, one of the oldest senses, allowing the organisms with receptors for the odorant to identify food, potential mating partners, dangers and enemies. For most living creatures and for mankind smell is one of the most important ways of interaction with the environment. The most significant role of olfactory signals in humans appears to be the modulation of their behavior and interpersonal relationships. In this work *Drosophila* genome is taken as the model and docked in bioinformatics platform with cosmetic perfumes and deodorants. Docking scores of below -3000kcal/mol has been considered that can induce the behavioral changes including sexual behavior.

**Keywords:** *Drosophila*, aroma chemicals, Olfactory sense, behavior and interpersonal relationships, perfumery industry

## I. INTRODUCTION

*Drosophila* flies (small fruit flies) belongs to the family *Drosophilidae* having characteristic to linger around overripe or rotting fruit [1]. They are most widely preferred model organisms in biological research across the world [1]. Several discoveries in biological research have been made using *drosophila* flies and also as because its genome is fully sequenced; there is enormous information available about its biochemistry, physiology and behavior [2].

Almost all of aroma chemicals are obtained through chemical synthesis and plants derived natural raw materials are also present along with animal derived products are present in perfumery industry [3, 4].

Fragrances creator also called perfumer have a unique talent [5, 6, 7, 8]. Modern day perfumers use approximately 1,200 aroma chemicals of various odour directions to create fragrances for various applications [5, 6, 7, 8]. Fragrances are thus complex

mixtures of aroma chemicals usually created for non-food applications as liquids normally, emitting at least in diluted form a pleasant smell for humans and contain in average approximately 40 to 100 single ingredients in various dosage levels. Fragrances are made with individual applications like soap, detergent, fine fragrance etc for the five senses (sight, hearing, taste, touch and smell) smell or better chemoreception [9, 10]. This activity initiates with an interaction of odourants with receptors of the olfactory epithelium in the nose, signals are then processed by the olfactory bulb and from there the signals are transmitted to various structures in the human brain beside others to parts of the limbic system – an area where also emotions and memory have their origin [11, 12, 13, 14]. From this we can understand why odour impressions can trigger such strong emotions in humans [13, 14,15]. This forms the basis for this work.

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## II. METHODOLOGY

The *Drosophila*'s genome receptor is used in this work (Table 1) and is docked with the chemical constituent of different perfumes/deodorants to establish our objective.

Table 1: *Drosophila*'s genome receptor with their genbank accession number

<i>Drosophila</i> 's genome receptor	Genbank accession number
<i>Drosophila virilis</i>	EDW57826.29
<i>Drosophila mojagensis</i>	EDW12555.2
<i>Drosophila mojagensis</i>	EDW14323.2

### Common Chemical Types And Their Usage In Fragrance Industry (Table 2)

Ethyl denatured: AXE, FOGG, ENGAGE, SPINZ

Diethyl phthalate: FOGG, ENGAGE

Limonene: AXE, ENGAGE

Triclosan: FOGG, SPINZ

Table 2: Common perfumes with their ingredients

PERFUMES	INGREDIENTS
AXE SIGNATURE MYSTERIOUS	Alcohol Dena (95%V/V), Content, 95% Denatured with Tert Butyl Alcohol and Deanonum Benzoate, Perfume, Alpha -Isomethyl Lonoan, Citrol,Citronellol, Coumarin, Geranol, Hexylcumarral, Hydroxycitronellal, Limonene, Linalool.
FOGG -MAJESTIC	Ethyl Alcohol,DEP, Propylene Glycol, Triclosan, Alcohol 95(V/V) Content- 89.5% W/W and 1% Of W/W Diethyl Pthalate
ENGAGE SPELL	Ethyl Alcohol (95% V/V), 43.8%W/W, Diethyl Pthalate, 1% W/W Propellant, Ethyl Alcohol, Fragnance, Propylene Glycol, Diethyl Phthalate, Butylphenyl, Methyl Propanol, Crernol, Hexyl Unamal, Hydroxyutronellal, Limonene, Linalool.
SPINZ - EXPLORER	Ethyl Alcohol(95%V/V), 45w/W, Propane-Butane-Isobutane, Water, Propylene Glycol, Triclosan, T, Butyl Alcohol, Sodium Lacitate, T-Butyl Hydroquinone, Denatonium, Benzoate.

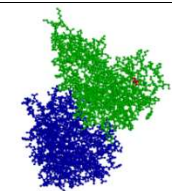
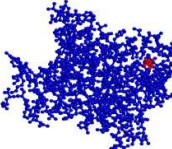
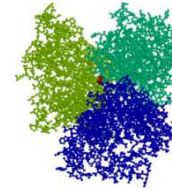
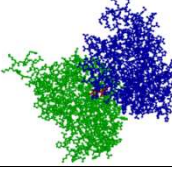
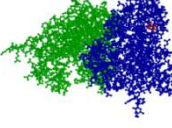
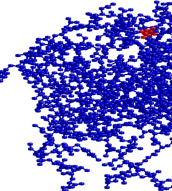
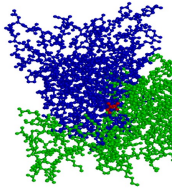
## III. RESULTS

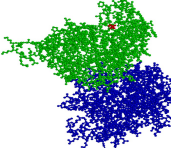
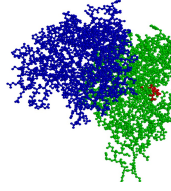
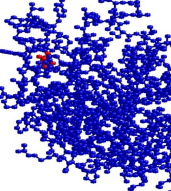
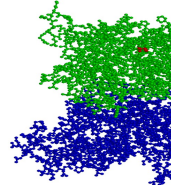
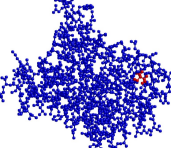
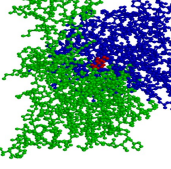
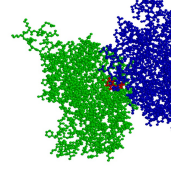
**The 3D structure of *Drosophila*'s genome receptor** is modeled using SWISS-MODEL server [16]. This 3D structure is docked with the ingredients of perfume using patchdock server (Table 3) [17].

Table 3: Docking results of *Drosophila*'s genome receptor with ingredients of common perfumes

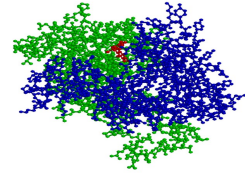
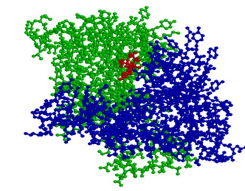
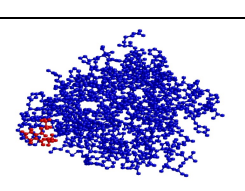
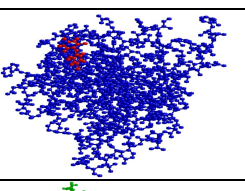
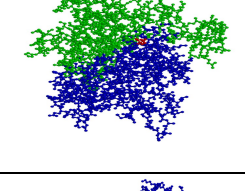
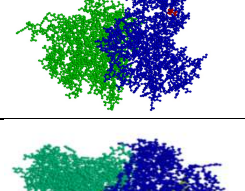
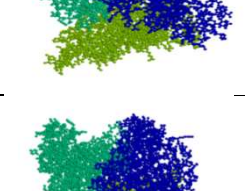

<i>Drosophila</i> 's genome receptor	Docked structure	Docking score (-kcal/mol)
<i>Drosophila mojagensis</i> docked with Triclosan		3950
<i>Drosophila mojagensis</i> docked with Diethyl phthalate		3962
<i>Drosophila virilis</i> docked with triclosan		3970
<i>Drosophila mojagensis</i> docked with diethylphthalate		4092
<i>Drosophila virilis</i> docked with diethylphthalate		3792
<i>Drosophila mojagensis</i> docked with Propylene		2040

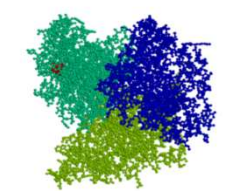
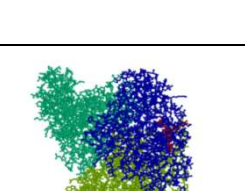
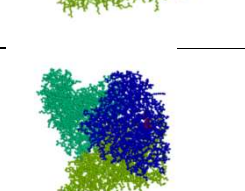
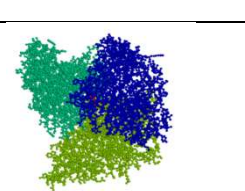
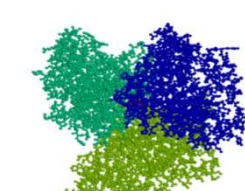
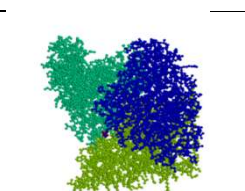
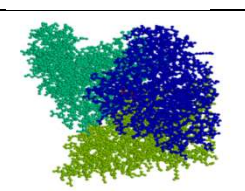


glycol		
<i>Drosophila</i> <i>mojavensis</i> docked with ethanol		1590
<i>Drosophila</i> <i>virilis</i> docked with ethanol		1610
<i>Drosophila</i> <i>mojavensis</i> docked with Ethanol		1618
<i>Drosophila</i> <i>mojavensis</i> docked with triclosan		4578
<i>Drosophila</i> <i>mojavensis</i> docked with Propylene glycol		2004
<i>Drosophila</i> <i>virilis</i> docked with Propylene glycol		1610
<i>Drosophila</i> <i>mojavensis</i> docked with Ethyl alcohol		1568

<i>Drosophila</i> <i>mojavensis</i> docked with Propylene glycol		1590
<i>Drosophila</i> <i>mojavensis</i> docked with Diethyl pthalate		4106
<i>Drosophila</i> <i>virilis</i> docked with Ethyl alcohol		1586
<i>Drosophila</i> <i>mojavensis</i> docked with Ethyl alcohol		1596
<i>Drosophila</i> <i>virilis</i> docked with Triclosan		1880
<i>Drosophila</i> <i>mojavensis</i> docked with Triclosan		2060
<i>Drosophila</i> <i>mojavensis</i> docked with Ethanol		4352

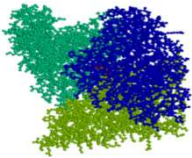
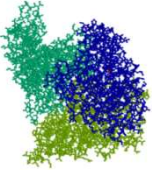
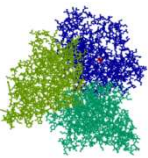
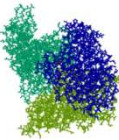
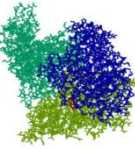
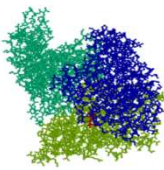
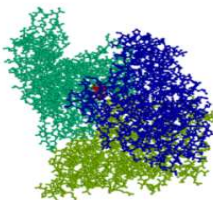
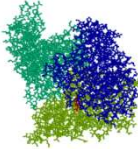


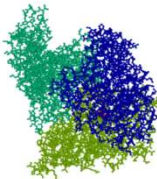
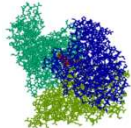
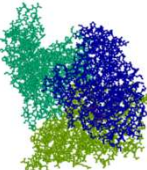
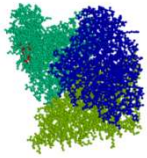
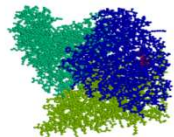
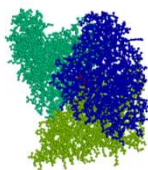
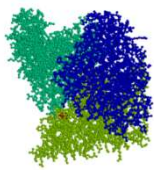
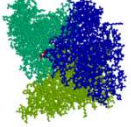
Drosophila mojavensis docked with Ethanol		4244
Drosophila mojavensis docked with Diethyl pthalate		3824
<i>Drosophila</i> <i>virilis</i> docked with Diethyl pthalate		3794
<i>Drosophila</i> <i>virilis</i> docked with Ethanol		3970
Drosophila mojavensis docked with Propylene glycol		1568
Drosophila mojavensis docked with Triclosan		2004
Drosophila mojavensis docked with linalool		3538
Drosophila mojavensis docked with citral		1618

Drosophila mojavensis docked with Alpha- isomethyl ionone		3546
Drosophila mojavensis docked with Hexyl cinnamal		5690
Drosophila mojavensis docked with Hydroxy citronellal		3650
Drosophila mojavensis docked with Coumarin		3328
Drosophila mojavensis docked with Citonellol		3646
Drosophila mojavensis docked with Denatured alcohol		1618
Drosophila mojavensis docked with limonene		3482





Drosophila mojavensis docked with geranial		3526
Drosophila mojavensis docked with Citral		1604
Drosophila mojavensis docked with Denatured alcohol		1604
Drosophila mojavensis docked with coumarin		3210
Drosophila mojavensis docked with Citonellol		3690
Drosophila mojavensis docked with Linalool		3826
Drosophila mojavensis docked with Alpha isomethyl ionone		4466
Drosophila mojavensis docked with Limonene		3404

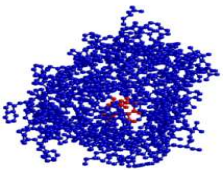
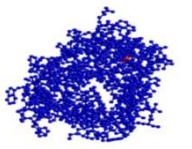
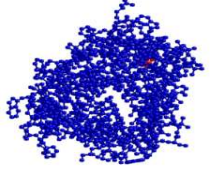
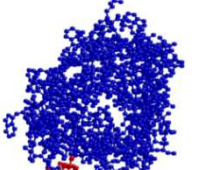
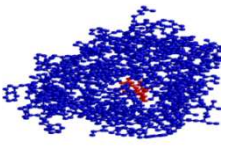
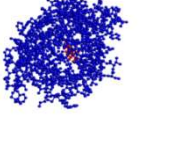

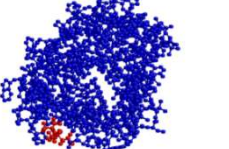
Drosophila mojavensis docked with Geranial		3734
Drosophila mojavensis docked with Hexyl cinnamal		6524
Drosophila mojavensis docked with Hydroxy citronellal		3784
Drosophila mojoventis docked with Denatoni m benzoate		4604
Drosophila mojoventis docked with Triclosan		3950
Drosophila mojoventis docked with t-butyl hyoquione		3294
Drosophila mojoventis docked with Butyl alcohol		2350
Drosophila mojoventis docked with Sodiumlact ate		2082

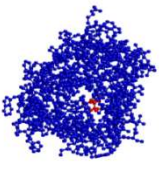
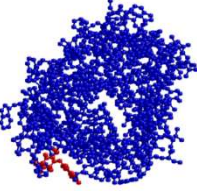
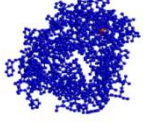
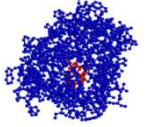
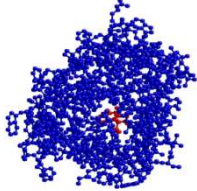
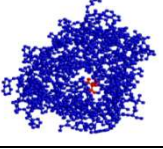


Drosophila mojavensis docked with Denatured alcohol		1618
Drosophila mojavensis docked with t-butyl hyoquione		3294
Drosophila mojavensis docked with Butyl alcohol		2350
Drosophila mojavensis docked with Sodium lactate		2082
Drosophila mojavensis docked with Denatured alcohol		1618
Drosophila mojavensis docked with Propylene glycol		2040
Drosophila mojavensis docked with Denatured alcohol		1604
Drosophila mojavensis docked with t-butyl alcohol		2340

Drosophila mojavensis docked with Propylene glycol		2000
Drosophila mojavensis docked with Sodium lactate		2054
Drosophila mojavensis docked with t-butyl hyoquione		3250
Drosophila mojavensis docked with Denatoniun benzoate		5056
Drosophila mojavensis docked with Triclosan		4590
<i>Drosophila virilis</i> docked with geranial		3302
<i>Drosophila virilis</i> docked with citronellol		3200
<i>Drosophila virilis</i> docked with Hexyl cinnamal		5926



<i>Drosophila virilis</i> docked with Alpha isomethyl ionone		3528
<i>Drosophila virilis</i> docked with Denatured alcohol		1610
<i>Drosophila virilis</i> docked with citral		1610
<i>Drosophila virilis</i> docked with linalool		3358
<i>Drosophila virilis</i> docked with Limonene		2858
<i>Drosophila virilis</i> docked with Hydroxyl citranellal		3424
<i>Drosophila virilis</i> docked with Propylene glycol		1880
<i>Drosophila virilis</i> docked with coumarin		2826

<i>Drosophila virilis</i> docked with Sodium lactate		2008
<i>Drosophila virilis</i> docked with Triclosan		3970
<i>Drosophila virilis</i> docked with Denatured alcohol		1610
<i>Drosophila virilis</i> docked with Denatoniun benzoate		4506
<i>Drosophila virilis</i> docked with t-butyl hyoquione		2854
<i>Drosophila virilis</i> docked with t-butyl alcohol		2144

#### IV. CONCLUSION

The compounds Diethyl phthalate and triclosan of Engage spell deodorant docks with a high score with *Drosophila* sp. as per the docking analysis. Hence, these compounds of Engage spell deodorant can induce behaviour changes including the sexual behaviour in the *drosophila* sp.





The Diethyl phthalate and ethanol of Fogg deodorant docks with high score with *Drosophila* sp. as per the docking analysis. Hence, these compounds of Fogg deodorant can induce behavior changes including the sexual behavior in the *drosophila* sp.

The compounds linalool, Alpha-isomethyl ionone, Hexyl cinnamal, Hydroxy citronellal, Coumarin, Citonellol, limonene, geranial of Axe deodorant docks with a high score with *Drosophila* sp. as per the docking analysis. Hence, these compounds of Axe deodorant can induce behaviour changes including the sexual behavior in the *drosophila* sp.

The compounds Denatonium benzoate, Triclosan, t-butyl hyoquione of Spinz deodorant docks with high score with *Drosophila* sp. as per the docking analysis. Hence, these compounds of Axe deodorant can induce behavior changes including the sexual behaviour in the *drosophila* sp.

The above compounds are to be validated with assay studies to establish their efficacy in inducing behavior changes in *drosophila* sp.

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