

# Decision-making in feeding and mating behaviors of field collected fruit flies (*Drosophila melanogaster*)

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## Abstract

Fruit flies (*Drosophila melanogaster*) are excellent animal models to study how the brain makes decisions. Our main purpose is to test the flies' ability to **choose between conflicting excitatory inputs: feeding and mating**. We observed pairs of virgin flies (a male and a female) and compared their behavior to non-virgin flies in a testing arena containing food.

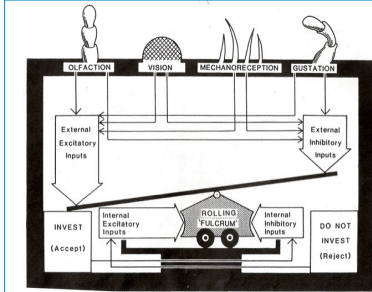
We used scan sampling with instantaneous recording of eight behaviors, including feeding and mating. Our results show that mating status influences the flies' behavior. Non-virgin flies tend to court longer, whereas virgin flies are more likely to spend longer time mating. This shows that the flies' brain is making different choices based on the internal and external inputs.

## Introduction

In animals, the brain processes information relayed by the sensory systems and makes decisions between conflicting behaviors, such as mating and feeding (Bell, 1991).

Figure 1 shows a model to explain how the brain uses excitatory and inhibitory information from internal and external sources to make decisions about feeding or mating.

When the beam falls on the decision to invest, the animal feeds or mates. This is more likely to happen when excitatory inputs are larger than the inhibitory inputs. Internal inputs also push the "fulcrum" so that the probabilities of engaging in a behavior are higher.



**Figure 1:** The Rolling Fulcrum: Mechanical analogue of Dethier's 1982 model for the influence of external and internal factors on insect behaviors (Miller and Strickler, 1984).

## Purpose

- To establish a behavioral time budget for fly pairs (male and female) in the presence of food.
- To test whether virgin flies make different choices about feeding and mating than non-virgin flies.

## Methods and Materials

Fruit flies (*Drosophila melanogaster*) were collected in the field near Weatherford, OK in the summer of 2010 and kept in the laboratory in the incubator at 22+/-2 °C. Adults were tested at 7-21 days of age. All flies were placed in individual vials with access to food after eclosion.

We observed 12 virgin pairs (male and female) and 12 non-virgin pairs of flies using scan sampling with instantaneous recording every minute for forty minutes (Ploger and Yasukawa, 2003). Each pair of flies was placed in a testing arena (Figure 2).

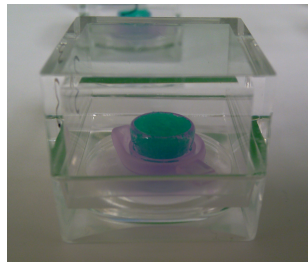
We recorded the following behaviors:

**Male Following** – The male fly chases the female.

**Male Song** – The male fly vibrates one wing and tries to court the female.

**Male Trying to Mount** – The male fly tries to get on top of the female and mate.

**Mating, Eating, Grooming, Exploring/Walking, and Laying Eggs**



**Figure 2:** Arena (2.5 x 2.5 cm) containing food where a pair of flies (male and female) was observed.

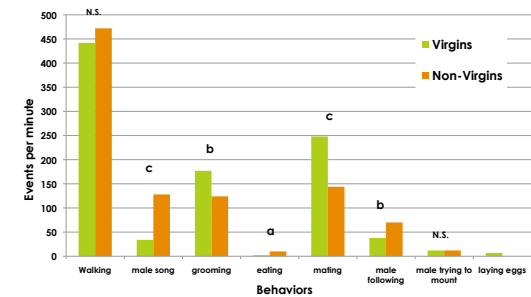
## Results

Both virgin and non-virgin flies spent most of the time walking, followed by mating, and grooming (Figure 3).

Virgin flies spent more time grooming and mating than non-virgin flies (Figure 4).

Non-virgin males spent more time performing the courtship song and following the female than virgin males (Figure 4).

The time spent walking and trying to mount (male) was not significantly different between the two groups (Figure 4).



**Figure 4:** Total number of behavioral events for 12 pairs of virgin flies vs. 12 pairs of non-virgin flies. Chi-square test for number of occurrences. **a** =  $p < 0.025$ , **b** =  $p < 0.005$ , **c** =  $p < 0.001$ , **N.S.** = not significantly different.

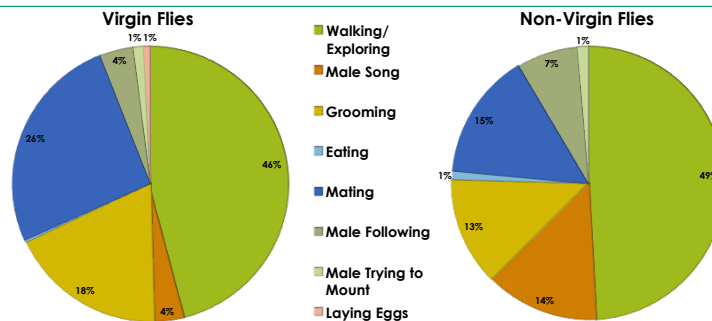
## Conclusions

① Mating status (virgin vs. non-virgin) does influence the behavioral choice (mating vs. not mating).

② Previous mating changes the hierarchy of behaviors performed by the flies, making them more likely to choose different behaviors.

The next step in this project is to test the effect of **food deprivation** (a different internal excitatory stimulus) on the same behaviors. We predict that hungry flies will be more likely to eat and less likely to mate.

## Results



**Figure 3:** Time budgets (percentage) for eight different behaviors in virgin and non-virgin flies.

## References

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## Acknowledgements

The authors wish to thank Dr. Peter Grant for providing the flies. Funding was provided by OK-LSAMP and NASA awards to I. Lopez and endowment funds from Biological Sciences at SWOSU to J. Aracena.