

hpo has sexually dimorphic gene expression in male and female fruit flies

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Summary

- *Drosophila melanogaster* (fruit flies) were exposed to GenX
- Expression of gene *hpo* was quantified using qRT-PCR
- Female express significantly less *hpo* than males at baseline

Abstract

Chemical pollutants in the environment can have significant sublethal impacts on organisms. Female and male organisms have sexually dimorphic gene expression and may exhibit different responses to chemical stressors on a transcriptional level. Here, we exposed *D. melanogaster* to GenX, a chemical with unknown toxicity, and measured the expression of the gene *hpo* using qRT-PCR. After GenX exposure, females upregulated *hpo* 2.96-fold ($p=0.0734$) and males downregulated *hpo* 1.86-fold ($p=0.256$) compared to control conditions. Females have a 16.9-fold lower baseline expression of *hpo* compared to males. We conclude that males have a significantly higher baseline expression of *hpo* compared to females.

Introduction

Hypothesis

Exposing fruit flies to GenX will cause an upregulation of *hpo*. Male and female fruit flies will express similar levels of *hpo*.

Fruit Flies

- 60% of genes have homologs in humans
- 75% of disease-associated genes
- Easy to distinguish between sexes

GenX

- Replacement for PFOA, used in nonstick products
- Toxicity and safety levels are unknown

hpo

- implicated in pathway controlling cell growth, proliferation, and apoptosis (1)

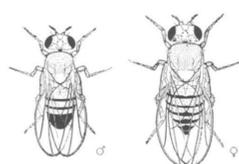


Figure 1. Female and male adult fruit flies. Male fly is on the left, and female fly is on the right.

Methodology

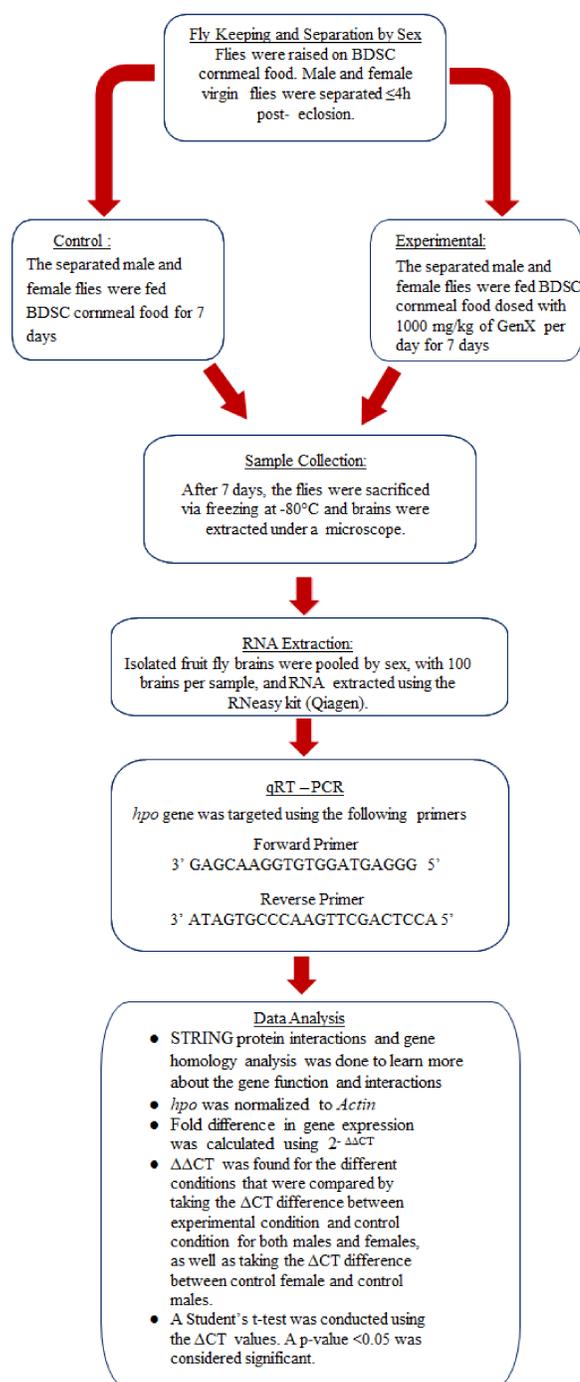


Figure 2 Flowchart of experimental design.

Results

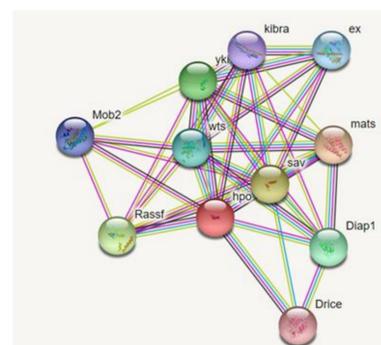


Figure 3. STRING protein interaction of *hpo*. *hpo* is involved in the hippo/SWH pathway and these are other proteins in that pathway. Generated using <https://string-db.org/>

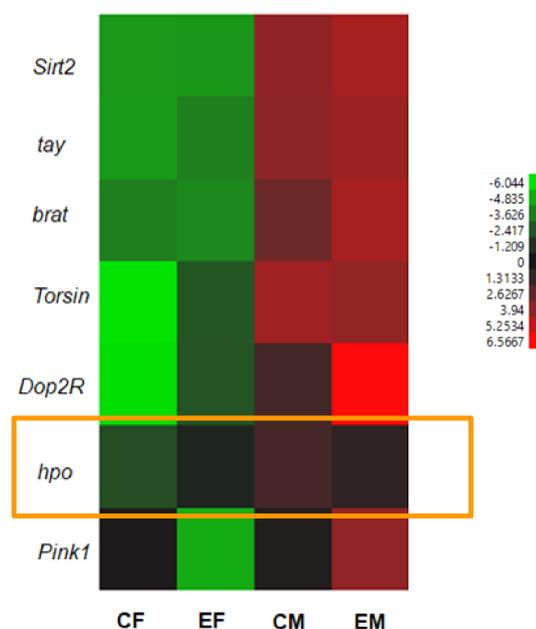


Figure 4. Heat map of gene expression in fly brains based on Δ CT values from qRT-PCR. Green indicates downregulation of a gene, and red indicates upregulation of a gene. CF represents Control Female, EF represents Experimental Female, CM represents Control Male and EM represents Experimental Male. *hpo* was upregulated 2.96-fold in experimental females compared control females (p -value=0.0739), downregulated 16.9-fold in control females compared to control males (p -value=0.00699) and downregulated 1.85-fold in experimental males compared to control males (p -value=0.256).

Conclusion

- *hpo* is involved in a signaling pathway that regulates tissue size.
- Turning on the Hippo/SWH pathway causes an increase in cell death and a decrease in cell growth.
- *hpo* has sexually dimorphic gene expression, with a 16.9-fold difference in control males and females (p -value = 0.00699).
- *hpo* does not have a statically significant change in gene expression for either the experimental male or female flies (p -value > 0.05).
- Since the expression of *hpo* is upregulated in male flies compared to female flies, this can potentially explain why male flies are smaller than female flies.
- GenX does not significantly alter gene expression of *hpo*, suggesting that in the given exposure and time point, there is not much of change to tissue growth in flies.

Limitations and future directions

- ❖ Only one concentration of GenX was used to test the flies.
- We can use different concentration ranges of GenX to observe the effects on changes in gene expression in fly brains.
- ❖ Changes in gene expression were only measured in the brain. Since *hpo* can be expressed in other parts of the body, we are not able to tell if gene expression is altered there too.
- We can use other parts of the fly to conduct qRT-PCR and study changes in gene expression.
- ❖ Flies were exposed for only 7 days.
- We can measure changes in gene expression over longer periods of exposure to GenX.

References

FlyBase Gene Report Dmel_ *hpo*. <https://flybase.org/reports/FBgn0261456>