

Sid (stress-induced *DNase* type-I) gene in *D. melanogaster* heads is more active in males than females by 4-fold under control conditions

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Summary

- Is there a significant difference in gene expression of *Drosophila melanogaster* (fruit fly) gene *Sid* in male and female heads?
- Extracted RNA from male and female fly heads and used qRT-PCR to measure gene activity.
- *Sid* gene is significantly more expressed in male flies by four-fold under controlled conditions.

Abstract

Differences in gene expression of male and female *Drosophila melanogaster* were tested through RNA extracted from their heads. qRT-PCR was used to measure gene expression of *Sid*, a gene involved in physiological stress pathways, under normal conditions in males and females. The results showed the *Sid* gene was significantly more active in males than females by a 4-fold difference.

Introduction

Hypothesis

Gene expression of *Sid* will not change between male and female fruit flies in control conditions.

Significance of model organism

- Human medicine research is historically male oriented
- 75% human disease genes conserved between humans and flies¹

Background

Why the Fruit Fly? ^{2,3}

- Small, easy to store, inexpensive
- Reproduce quickly
- 10-12 day for flies to mature
- Each female can lay up to 500 eggs
- Fly research has won 6 Nobel prizes
- Fly brains were used to study tissue specific gene expression, and because brains have high metabolic activity.

Gene of Interest: *Sid*

- Stress-related gene
- Induced by bacterial infection and oxidative stress
- Protects from toxic effects of excess DNA and RNA released by vigorous immune response⁴

Materials and Methods

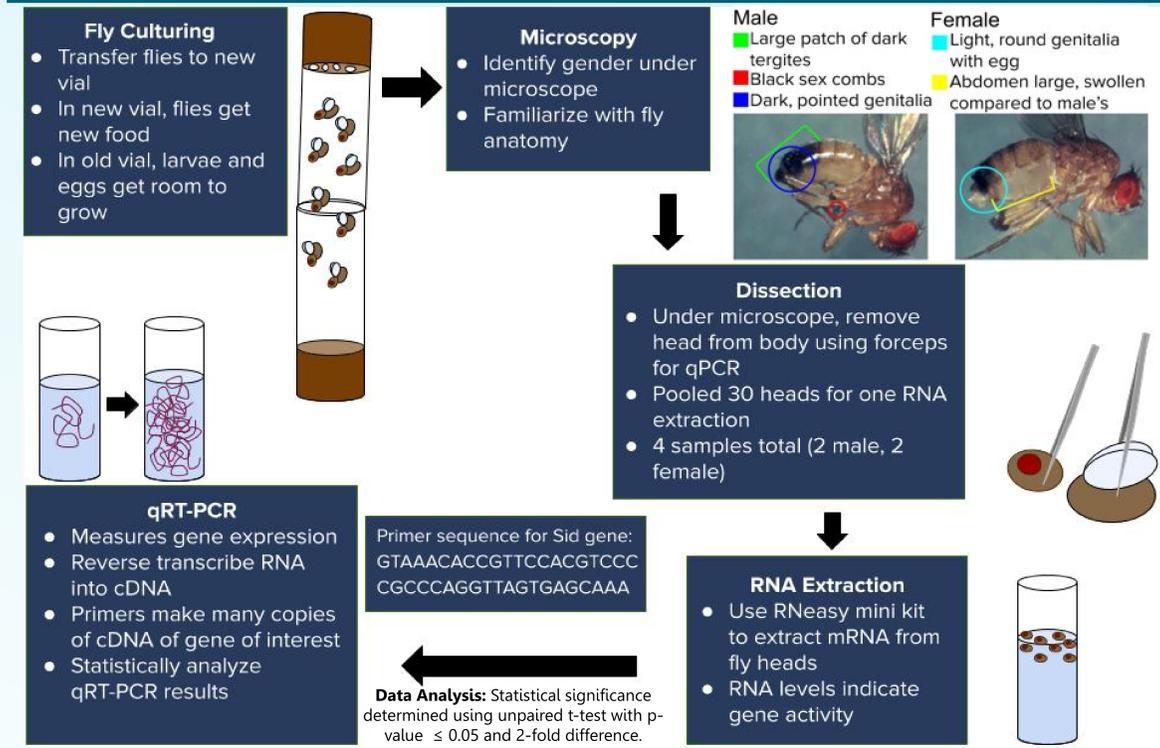


Figure 1. Flowchart of experimental progression.

Results

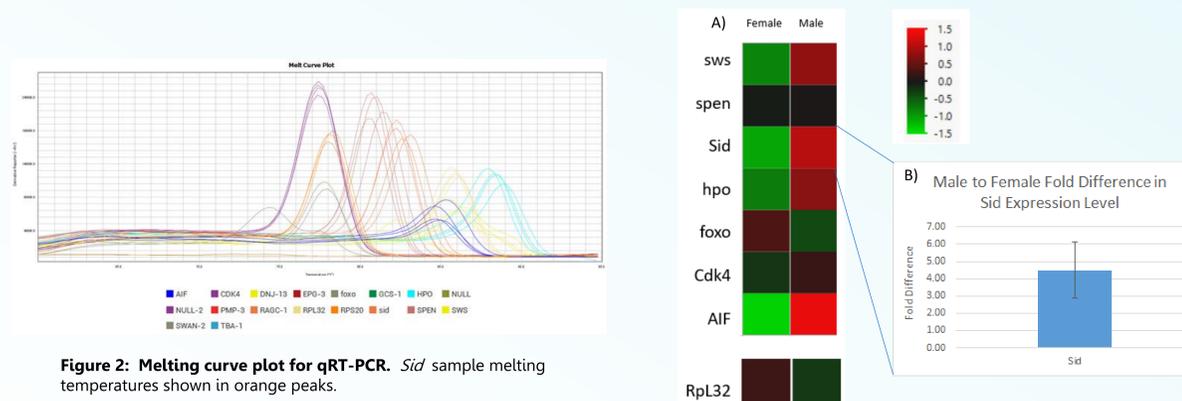


Figure 2: Melting curve plot for qRT-PCR. *Sid* sample melting temperatures shown in orange peaks.

Figure 3. Gender-based differential gene expression in *Drosophila melanogaster*. A) Heatmap generated by JMP Pro. Lower relative expression is indicated by green, while higher relative expression is indicated by red. B) *Sid* gene expression is 4.49 fold more in male fruit flies versus female fruit flies when normalized to housekeeping *RpL32* gene⁵; p-value = 0.045

Conclusion/Discussion

The heatmap showed that *Sid* is more active in male flies. Our results showed that males significantly, p-value = 0.045, expressed *Sid* four-fold more than female fruit flies (Fig. 3). Although gene expression was hypothesized to be similar between males and females, there were differences even in a controlled environment.

The *Sid* gene encodes a protein from an enzyme family that degrades single and double stranded nucleic acids. This process is inducible by oxidative stress, bacterial infections, and protects from the toxic effect of excess RNA and DNA produced by a vigorous immune response. *Sid* activity is induced by bacterial infection. Our results imply a male and female might respond differently to a bacterial infection.

Study Limitation

- Our study did not account for individual variation between flies, samples included 30 heads each.

Future Direction

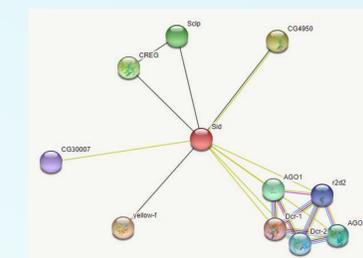


Figure 4. Proteins interacting with *Sid*. This figure is generated via STRING (<https://string-db.org/>).

- Study gene expression of flies under stress, e.g., heat or metabolic stress.
- Analyze proteins that coregulate with *Sid*, many of which are in stress response related pathways.

References

