Investigating the Role of DILP8 in *Drosophila melanogaster* Oogenesis

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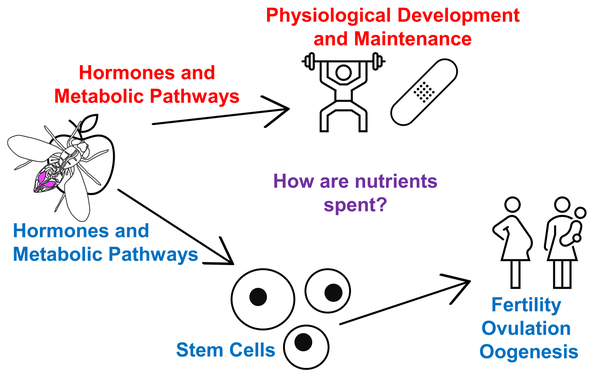
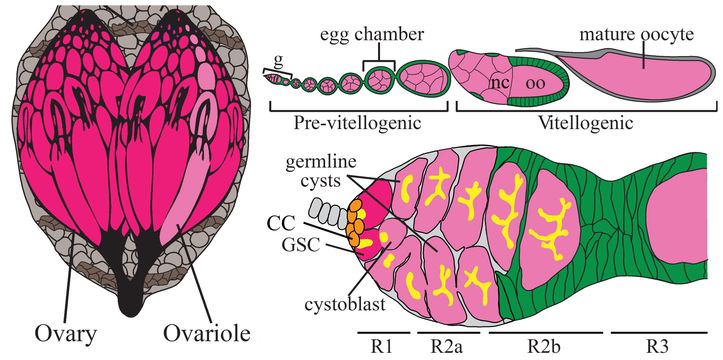
Abstract

Physiological adaptations allow organisms to respond to nutritional deficiencies, cellular damage and adverse/harsh environments. Since egg production is an energetically expensive process, these adaptations may be beneficial for the survival of the organism. *Drosophila melanogaster* ovaries exhibit a drastic decrease in egg production when exposed to poor nutritional conditions. Ovaries in *Drosophila* are stem cell supported and are sensitive to nutritional changes. Ecdysone, a steroid hormone, is a known regulator of a nutrition sensitive checkpoint between stages 8 and 9 of oogenesis and progressive vitellogenic stages. Biosynthesis of ecdysone has been shown to be inhibited by DILP8, an insulin like peptide hormone, highly expressed during imaginal disc regeneration in *Drosophila melanogaster* larval stages. Though it is expressed highly in the ovaries of adult female flies, the role of DILP8 in oogenesis in context of nutritional status is unknown. The relationship between DILP8 and ecdysone may offer a physiological mechanism that redirects energy resources in response to nutritional status. This study aims to determine the role of DILP8 in modulation of ecdysone regulated checkpoints in *Drosophila melanogaster* oogenesis.

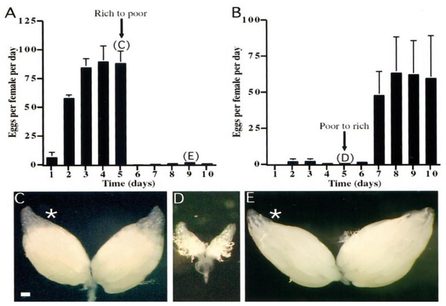
The Relationship Between Nutrition and Hormonal Signaling



Drosophila Oogenesis

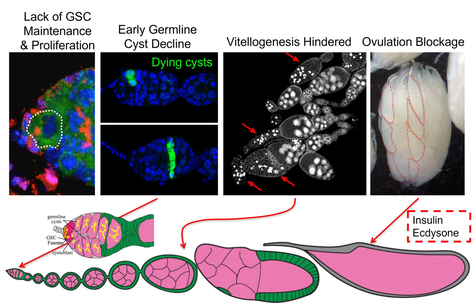


Drosophila Oogenesis is Sensitive to Nutritional Changes



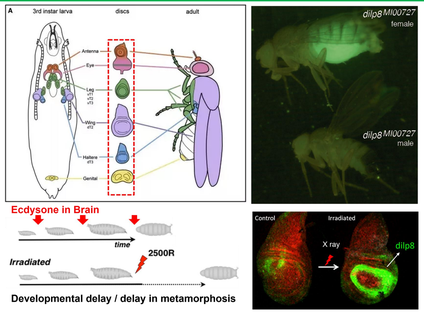
(Drummond-Barbosa et al 2001 to 2010)

The Effect of Poor Food on Oogenesis



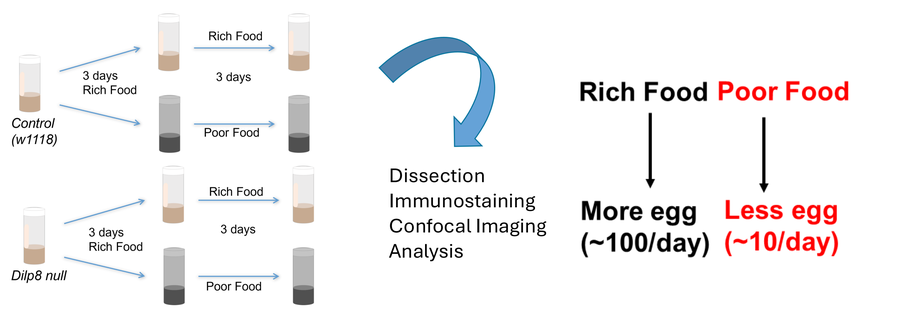
(Drummond-Barbosa et al 2001 to 2010)

DILP8 Coordinates Development of Growth by Modulating Ecdysone Levels



(Garelli et al 2012, Colombani et al 2012)

Methods



Results

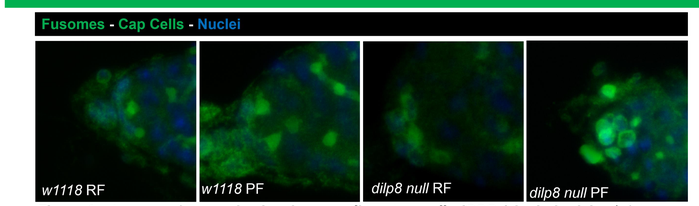


Figure 1a. Images of germaria showing germline stem cells (GSCs) in their niche, left to right; *w1118* RF, *w1118* PF, *dilp8 null* RF and *dilp8 null* PF. RF= rich food, PF= poor food.

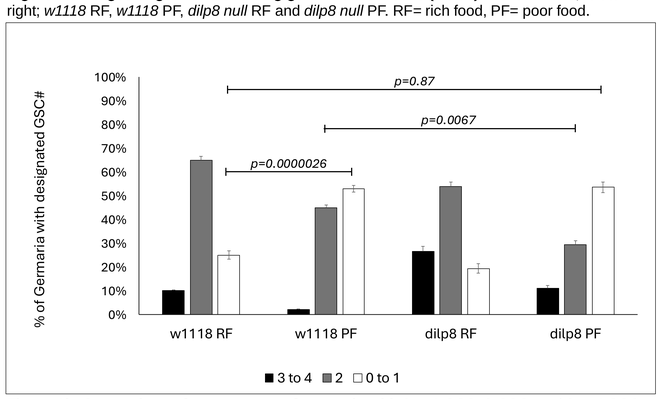


Figure 1b. Comparison of percentages of germaria with 0 to 1 GSC, 2 GSC, and 3 to 4 GSC #, left to right; *w1118* RF, *w1118* PF, *dilp8 null* RF and *dilp8 null* PF. RF= rich food, PF= poor food. Averages of 3 biological replicates with n~50, error bars are standard errors among replicates. Both *dilp8 null* RF and PF exhibit lower percentages of germariums with 2 stem cells compared to *w1118* RF and PF, respectively.

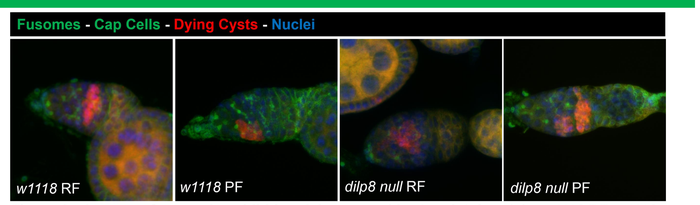


Figure 2a. Images of germaria exhibiting dying cysts (dcp1+ve), left to right; *w1118* RF, *w1118* PF, *dilp8 null* RF and *dilp8 null* PF. RF= rich food, PF= poor food.

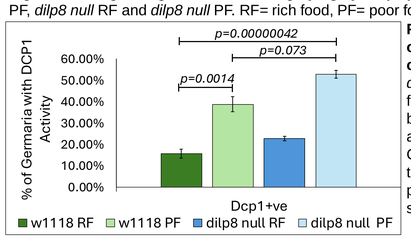


Figure 2b. Comparison of percentages of germariums exhibiting dcp1+ve cysts, left to right; *w1118* RF, *w1118* PF, *dilp8 null* RF and *dilp8 null* PF. RF= rich food, PF= poor food. Averages of 2 biological replicates with n~50, error bars are standard errors among replicates. Cyst death was higher for *dilp8 null* RF than for *w1118* RF, and the *dilp8 null* PF percentage was the highest among all samples.

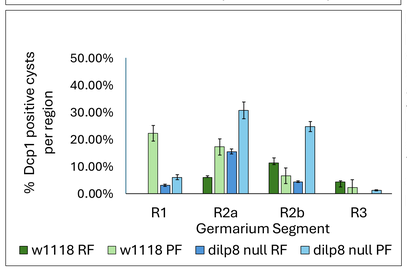


Figure 2c. Comparison of The percentages of germariums with dcp1+ve cysts in each region for each sample, left to right; *w1118* RF, *w1118* PF, *dilp8 null* RF and *dilp8 null* PF. RF= rich food, PF= poor food. Averages of 2 biological replicates with n~50, error bars are standard errors among replicates. The *dilp8 null* PF group had higher amounts of germariums with Dcp1 positive cysts in region 2.

Discussion and Conclusion

- We observe loss of germline stem cells as indicated by depletion of germariums with 2 and 3 to 4 GSCs and increase in germariums with 0 to 1 GSCs in *w1118* PF when compared to *w1118* RF as expected.
- The results so far indicate depletion of germariums with 2 GSCs in *dilp8 null* PF compared to *w1118* PF.
- Flies from *dilp8 null* PF had a greater percentage of Dcp1 positive cysts/dying cysts than other experimental groups. The majority of Dcp1 positive cysts were found in region R2 and the percentage was highest for the *dilp8 null* PF flies among the experimental groups.
- *dilp8 null* flies had a greater percentage of Dcp1 positive cysts than *w1118* in both poor and rich food.

A larger sample size is required to produce more conclusive data, but there is correlation between DILP8 deficiency, poor nutrition, and apoptosis.

Acknowledgements

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