Aug 6th, 9:30 AM - 12:00 PM

Role of ecdysone signaling in fat body remodeling

Marsha Kristel Bernardo
University of Nevada Las Vegas

N. Bond
University of Nevada Las Vegas

Allen G. Gibbs
University of Nevada, Las Vegas

Repository Citation

This Event is brought to you for free and open access by the Undergraduate Research at Digital Scholarship@UNLV. It has been accepted for inclusion in Undergraduate Research Opportunities Program (UROP) by an authorized administrator of Digital Scholarship@UNLV. For more information, please contact digitalscholarship@unlv.edu.
ROLE OF ECDYSONE SIGNALING IN FAT BODY REMODELING

Climate change is fundamentally connected to animal development and survival, and the life history of an organism must be coordinated with predictable seasonal changes of the environment. Climate change affects the life cycle of plants, a major food source for insects. If photoperiod, the primary environmental queue that insects utilize to determine the proper emergence time, and food availability becomes out of sync, many populations of insects and other animals could be threatened. Understanding animal development can provide insight into this issue and could provide clues that may help the scientific community predict how insect populations may respond to climate change.

During *Drosophila* metamorphosis, most of the larval tissues are destroyed, but the fat body is an exception. The larval fat body escapes destruction and is instead remodeled from flat, polygonal and attached sheets of cells to round, spherical and detached free-floating cells (Nelliot, et. al, 2006). It has been hypothesized that Ecdysone signaling is necessary for fat cell detachment. To test the hypothesis that Ecdysone signaling is necessary for fat cell detachment, I am using genetic techniques to create mosaic animals. These techniques will allow me to generate clones of cells that are deficient or hyperactive in certain Ecdysone signaling targets.

Currently, I am trying to establish animals for the first part of a two-step cross. Next, using the FLP/FRT and the Mosaic Analysis with a Repressible Cell Marker system (MARCM), I will generate mitotic clones of cells. These clones will be comprised of small populations of cells mutant for Ecdysone signaling factors and will be surrounded by normal (wild type) cells. I predict that the populations which are deficient in Ecdysone signaling factors will not undergo fat body remodeling while the surrounding pools of wild type cells will complete the remodeling program. These two types of cells can be distinguished from each other because I will also label the Ecdysone signaling-defective cells with green fluorescent protein. The data will be procured on the Confocal Microscope in the Center for Biological Imaging.
Role of Ecdysone Signaling in Fat Body Remodeling in Drosophila melanogaster

M. Bernardo, N. Bond, and A.G. Gibbs

School of Life Sciences, University of Nevada, 4505 Maryland Parkway, Las Vegas, NV 89154

ABSTRACT

In Dipterans, metamorphosis is depicted by the loss and transformation of larval tissues as the animal gets ready for adult life. Ecdysone signaling mediates several distinct biological responses of the metamorphosing animal including the programmed cell death of most larval tissues. During Drosophila metamorphosis, most of the larval tissues are destroyed, but the fat body is an exception. The larval fat body escapes destruction and is instead remodeled from flat, polygonal and attached sheets of cells to round, spherical and detached “free-floating” cells (Nelliot, et. al, 2006). It has been demonstrated that Ecdysone signaling plays a role in fat body remodeling (Cherbas et al., 2003). Here I present data that demonstrates a cell autonomous role for Ecdysone signaling mediated fat body remodeling.

INTRODUCTION

Ecdysone signaling triggers many developmental events in Drosophila melanogaster such as larval molts, puparium formation, pupal formation, and metamorphosis. The life history of Drosophila is characterized in part by three larval stages. After the third larval stage the animal prepares for metamorphosis. During metamorphosis, most of the larval tissues are lost through programmed cell death and new adult tissues are differentiated. All of these changes are initiated by the insect hormone 20-hydroxy-ecdysone (herein referred to as Ecdsone).

Our research focuses on the larval fat body of Drosophila melanogaster. During Drosophila metamorphosis, most of the larval tissues are destroyed but the fat body is an exception. The larval fat body escapes destruction and is instead remodeled from flat, polygonal and attached sheets of cells to round, spherical and detached “free-floating” cells (Nelliot, et. al, 2006). It has been demonstrated that Ecdysone signaling plays a role in fat body remodeling (Cherbas et al., 2003).

During pupariation, Ecdysone levels in Drosophila increase in preparation for metamorphosis. Different forms of Ecr are then associated with different programs of differentiation during the subsequent adult development (Riddiford, 1993). Aside from triggering developmental events, Ecdysone also initiates transcription of certain genes. One such gene is Ftz-F1, which is a competence factor dependent on the decrease of the Ecdysone titer.

METHODS

Stock animals were established for a two-step cross. Using the FLP/FRT and the Mosaic Analysis with a Repressible Cell Marker System (MARCMS) technology, mitotic clones of cells were generated. These clones are comprised of small populations of cells mutant for Ecdysone signaling factors and are surrounded by normal (wild type) cells.

RESULTS

We have determined that Ecdysone is necessary for fat body dissociation and remodeling. Ftz-F1 is a gene which encodes for a transcription factor and allows genes to respond to Ecdysone. When Ftz-F1 was blocked, the larval fat body populations which are deficient in Ecdysone signaling factors did not undergo fat body remodeling while the surrounding pools of wild type cells completed the remodeling program. These two types of cells were distinguished from each other by labeling the Ecdysone signaling-defective cells with green fluorescent protein. The data was then procured by the Confocal Microscope in the Center for Biological Imaging.

CONCLUSION

Ecdysone signaling is necessary for fat cell detachment during fat body remodeling. Ecdysone signaling cell autonomous and triggers expression of proteins that cause developmental changes in the individual cell.

REFERENCES


ACKNOWLEDGEMENTS

Supported by NSF/EPSCoR Grant #EPS-0851427 to MB. Special thanks to Dr. Robert Hoogenraad (Northwestern) for the we, halfpyros/p0, 7468/pyDrk lines and Dr. Andrew Andries for the F12/F17/FRT image.