

Growth Regulatory Pathway collaborates with Axial Patterning Genes to regulate Patterning and Growth in *Drosophila* Eye

Neha Gogia¹, Madhuri Kango-Singh^{1,2,3},
Amit Singh^{1,2,3,4}

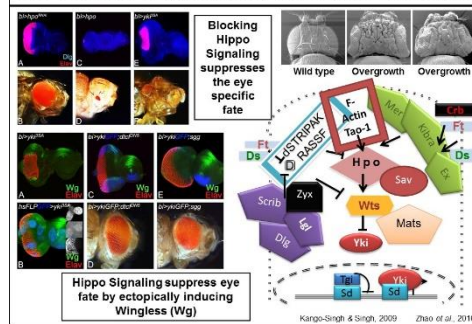


1) Department of Biology, University of Dayton, 300 College Park Drive, Dayton, OH; 2) Premedical Program, University of Dayton; 3) Center for Tissue Regeneration & Engineering (TREND), University of Dayton, 300 College Park Drive, Dayton, OH; 4) Center for Genomic Advocacy (TCGA), Indiana State University, Terre Haute, IN, USA.

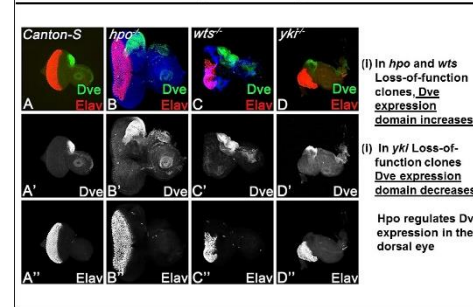
Abstract

In any multicellular organism, organogenesis requires axial patterning to determine Antero-Posterior (AP), Dorsal-Ventral (DV), and Proximo-Distal (PD) axes. Any deviation in these axes during development leads to congenital birth defects. In our model system, *Drosophila melanogaster* (a.k.a. fruit fly), Dorsal-Ventral (DV) patterning marks first lineage restriction event. We have identified *defective proventriculus* (*dve*-a Homeobox gene), an ortholog of SATB homeobox 1 (special AT-rich sequence binding protein 1), as a new member of DV patterning gene hierarchy. We have shown that *dve* acts downstream of *pannier* (*pnr*, GATA-1 transcription factor), and upstream of *wingless* (*wg*) in dorsal gene hierarchy. Loss-of-function of *dve* or *pnr* results in dramatic dorsal eye enlargements, whereas gain-of-function suppresses the eye fate. We have demonstrated that *Wg* is a downstream target of Hippo growth regulatory pathway (highly conserved) in eye. Furthermore, *Wingless* (*Wg*), which acts downstream of *dve*, also exhibits similar eye enlargement and suppression phenotypes and has been shown to play a role in growth. Here, we present that DV patterning genes interact with Hippo signaling to regulate the common downstream target, *Wg* during growth and patterning of developing *Drosophila* eye. Our data (using Gain-of-function studies) states that activation of Hippo signaling in *dve*, *pnr* expression domain results in change of head specific fate to an eye. We have tested retinal determination fate markers in these backgrounds. This study will address an important question, whether the axial patterning genes (*dve*, *pnr*) and Hippo pathway regulates patterning and growth independently or in-coordination with each other by regulating *Wg* signaling in order to form an eye/or any organ. The results from these studies will be presented.

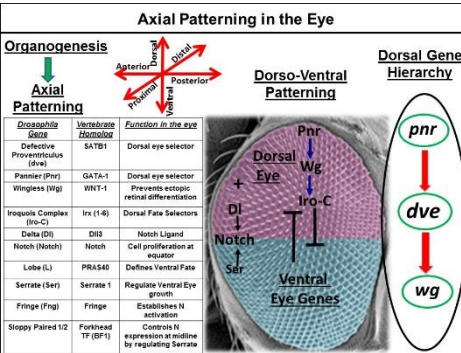
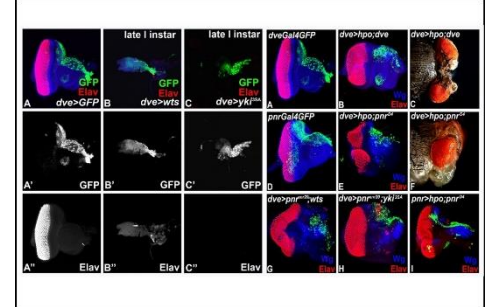
Loss-of-function of Hippo pathway exhibits growth phenotypes



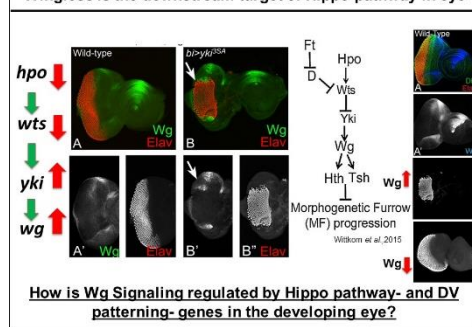
LOF of Hippo Signaling ectopically induces *Dve* expression in eye



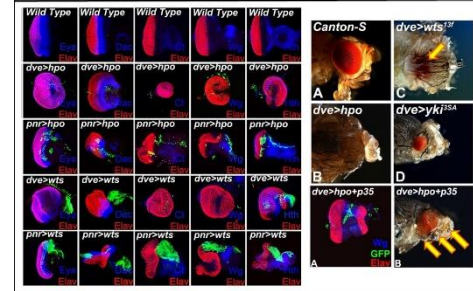
Hippo pathway members acts upstream of DV patterning genes



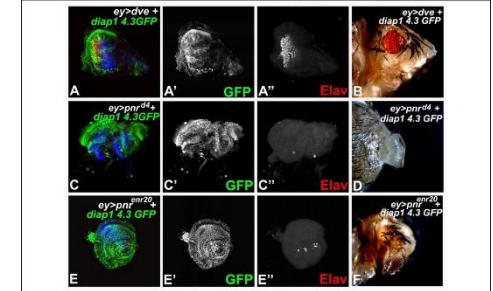
Wingless is the downstream target of Hippo pathway in eye



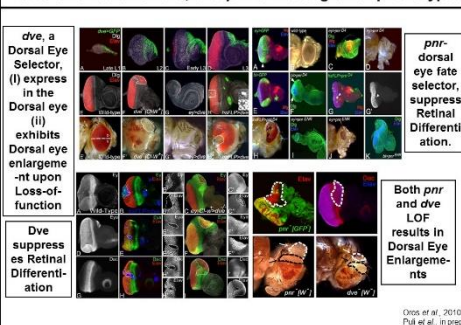
Activating Hippo Signaling suppresses *dve*, *pnr* expression, modulates *Wg* & transforms head, antenna cells fate to an eye by promoting ectopic Retinal Differentiation



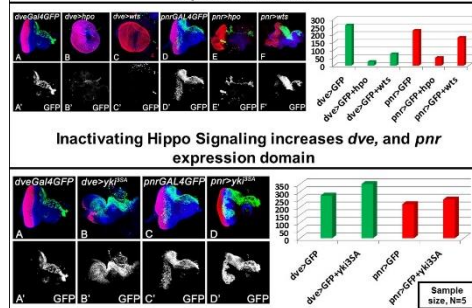
Downstream target of Hippo pathway, *Diap1* expression in eye gets upregulated when *pnr* and *dve* expression is induced in the entire developing eye of *Drosophila*



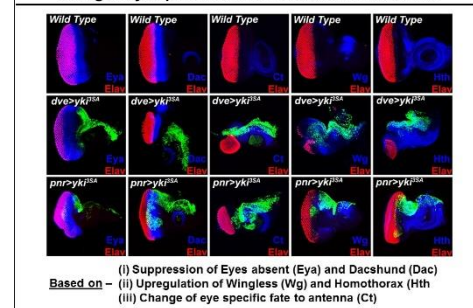
Loss-of-function of *dve*, and *pnr* exhibits growth phenotypes



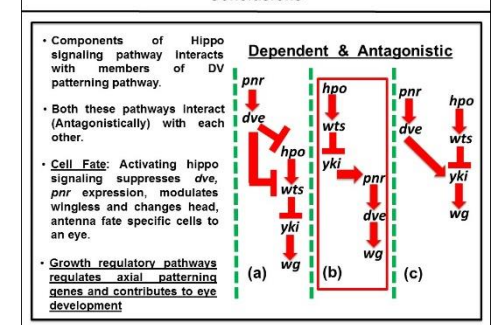
Activating Hippo Signaling reduces *dve*, and *pnr* expression domain



Inactivating Hippo Signaling in *dve* or *pnr* expression domain changes eye specific fate to head and antennal fate



Conclusions



Acknowledgement: We would like to thank Hideki Nakagoshi, Justin Kumar, Andreas Bergman, Bloomington Stock Center & DSHB for the reagents. NG is supported in part by the University of Dayton Office for Graduate Academic Affairs through the Graduate Student Summer Fellowship Program (GSSF) and the Department of Biology, University of Dayton.