Fly Meeting Report

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Introduction

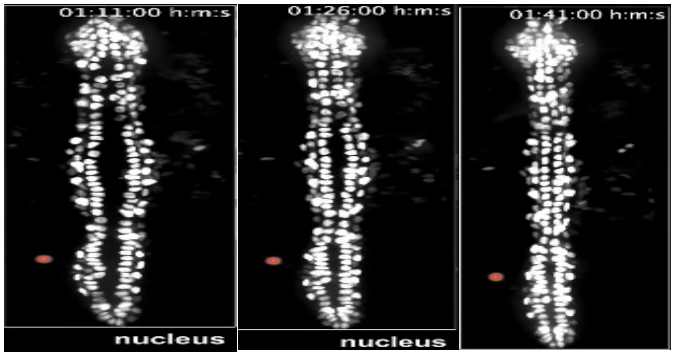
This virtual conference covered diverse biology topics ranging from developmental concepts, cellular and molecular mechanisms, neuroscience pathologies, and even biomedical aspects that could lead to new developments in prospective clinical treatments. Undergraduate and graduate students were given the opportunity to listen, observe, and learn from the researchers that had made biological discoveries/advancements, and a select few were even given the opportunity to speak and present research that they conducted themselves. Other attendees included postdocs, faculty, and principal investigators. The purpose of this conference was to update the science community on new discoveries from research conducted on the *Drosophila melanogaster*, as well as provide learning experiences about the research side of the STEM field.

One example of a learning experience offered through this conference was the Undergraduate Platform. This was one of my favorite sessions from the conference. The ability to look at other researchers around my age that are using techniques I have learned about, such as ChIP-seq and CRISPR, as well as perform research remotely, which I have experience with because of my Biochemistry course from last semester.

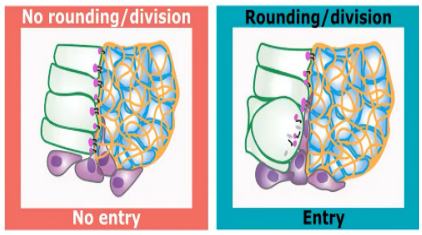
Another learning experience was the Tools and Techniques webinar, which went through investigative research techniques that study a wide range of biological mechanisms and structures. Some of the most interesting techniques would have been on high-speed 3D microscopy advances that were made by using a light sheet and apparatus with the galvo mirror. The SCAPE microscopy technique (Swept Confocally-Aligned Planar Excitation) was the real new advancement which allows for the observation of a single oblique plane of an object in real time. It is important because it is the only light microscopy system that allows for movement of only the plane without a hold on either the mirror or organism, and therefore a more comprehensive video can be observed. Another technique that piqued my interest and will play a largely important role in developmental biology in the future is going to be the connectome analysis tool: neuPrint. It will allow researchers to find neurons that are involved in certain pathways, or determine neurons involved in certain pathways that affect a certain place in the brain. This tool would be extremely helpful in determining where neurons are located within the embryo and their migration pathways during embryogenesis and embryo development.

Presentations

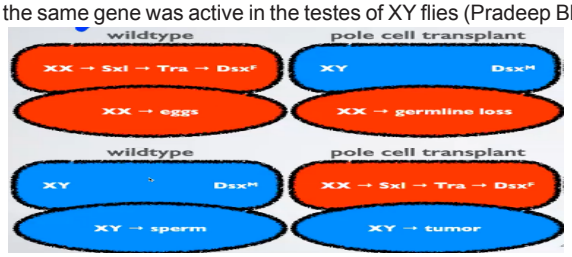
The first live talk I attended was given by Negar Balaghi. Her research investigated the mostly unknown underlying causes of congenital heart defects through cellular migration and alternating polarity of myosin in Drosophila. Their lab located the cardio blasts in the embryo as they migrated to the dorsal midline to form a tube. They used watershed algorithm imaging to track the migration of the myosin inside the nucleus of the cardio blasts as they oscillated forwards according to their dipoles. When they disrupted myosin motor activity, a higher variability in oscillation and contralateral communication between cardio blasts was observed.



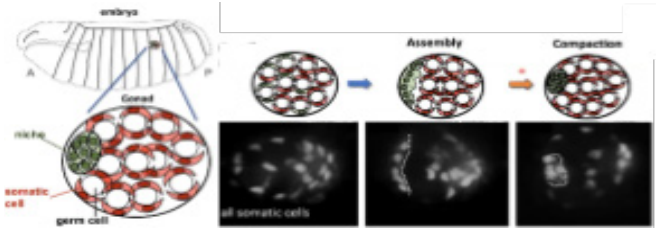
The second live talk I attended was done by Maria Akhmanova and covered the topic of macrophage invasion of embryonic tissues after epithelial cell division. They started by identifying the macrophages path as it penetrates and parts the ectoderm from the mesoderm, which companies miotic rounding and division of the surrounding epithelial cells. Division profiles determined that macrophage entry was always and only occurring at the same time as mitotic rounding and/or division. So, if the ectodermal rounding/division was required (necessary), which is typical of the "Lose It" type of developmental experiments. They ended up determining that focal adhesions disappear during cleavage events in the meso-ectoderm cell layers, further determined that mitotic rounding is indeed what enables macrophage tissue infiltration.



The third live talk I attended was "Zooming in on gonadogenesis." This talk was given by Brian Oliver of NIH and researched the sex transformations that occur when inserting male germ cells into a female, and vice versa. In addition to the transplanting of genes into the opposite sex, this experiment also investigated how important sex gene locations are. The results from this experiment found a gene that was active in the abdomen of an XX fly, while the same gene was active in the testes of XY flies (Pradeep Bhaskar).

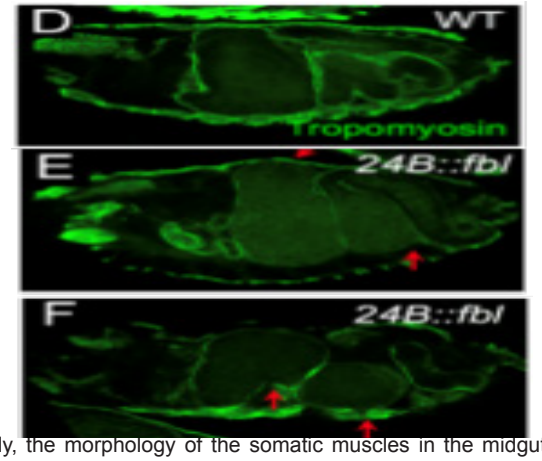


Their research from the germ cell insertion resulted in data that found a loss in the germline cells when a WT XX germ cell was inserted into a XY fly, and that the opposite resulted in a tumor. The fourth live talk I attended was given by Lauren Anllo. She spoke about the location of the stem cell niche in male flies which resides in the apex of the spiraled testes. They then looked at the testes during embryogenesis and found that niche cells seemed to be covered in visceral mesoderm (Vm). They then removed the Vm and observed irregular placement of the stem cells in the testes and determined that without the Vm, E-cadherin does not receive polarization and therefore cannot create the proper cell to cell connections in the stem cell niche in male Drosophila gonads.



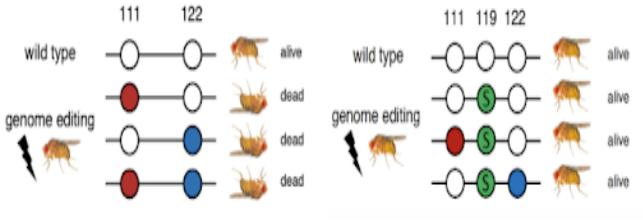
Posters

The first poster presentation I attended was given by one of the two presenters (the other had internet issues). Bronwyn Tollefson, of University of St. Thomas (UST) in Minnesota, investigated the ECM protein, Fibulin, and its role in structure development during embryogenesis. The first responsibility of this protein is to aid in corrected patterning of somatic muscles. When fibulin was knocked out through RNAi, abnormal fusions and spacings occurred between different ventral-longitudinal somatic muscle segments.



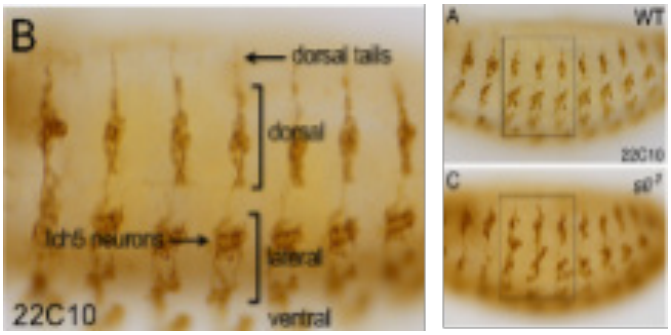
Additionally, the morphology of the somatic muscles in the midgut were defected when the embryos were altered to over-express fibulin (**D-F**).

The second poster presentation I attended was given by Arya Rao of Columbia University in New York. She had conducted research on the genetic basis behind the cardiac glycoside (CGs) resistance in WT Drosophila. She identified two amino acid sites with adaptive substitutions (mutations) that allowed these insects to inhibit the toxicity of CGs within their systems by inhibiting the Na+/K+ ATPase. These sites were 111, 122, and eventually 119. Genetic engineering of the first two amino acid sites in combinations, resulted in the death of all the WT flies.



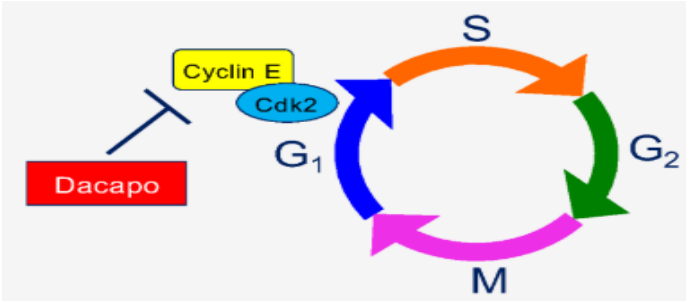
When the third site was then identified (119), it was determined to correlate with sites 111 and 122. When a substitution was inserted into this site, the WT flies were instead able to live through the mediation of the CGs toxicity.

The third poster presentation I attended was on the mechanism of slit in the PNS of *Drosophila*. This poster was presented by Maria A. Pizarro Salazar of UST. She researched the effect of the slit ligand in the PNS based off previous research on the function and importance of this ligand in the CNS. Through staining, it was found and over-expressed in glial cells, the ectoderm, and Ich5 neurons; specifically, their axons and muscle attachment sites of dorsal tails (**A, B**).



When over-expressed, slit in glial cells caused defects in abnormal axonal branching, loss of dorsal neurons, and mislocated neurons (**C**). In the ectoderm, the dorsal tail development was hindered, and resulted in a shortened dorsal tail. When over-expressed in PNS neurons, slit resulted in the incorrect localization of neurons in the embryo through 22C10 stains.

The fourth poster presentation I attended was given by another researcher fellow named Kaitlyn Solberg from UST. Her research attempted to identify the role of protein *dacapo* in the development of PNS neurons. They were found to reside in the abdominal segments of the flies. They then used its known function as a cyclin-dependent kinase (Cdk) inhibitor. This means it inhibits a subunit of Cdk's which normally activates the cyclin pathway. *Dacapo* was also found to play a role in determining whether a cell will continue to divide or if it will terminally differentiate.



Conclusion

I connected these posters to the lectures that involved the ECM and how influential the concentration of many cellular molecules and structures are to proper development, as well as the importance of embryonic patterning for proper physical development. I connected the live presentations to the themes from lecture that we have learned about, such as gonadogenesis, embryo cell migration and patterning, and the crucial proteins in the cell and the ECM that drive proper development. All these talks resulted in discoveries that further reiterated the importance of these themes in developmental biology. These discoveries will aid scientists in continuing to better understand *Drosophila* genes in the hopes that their research can help learn more about specific disease pathologies in humans. During these presentations I spoke and formed connections with researchers from UST, such as Bronwyn Tollefson, Maria Pizarro Salazar, and Kaitlyn Solberg. I also have emailed and connected with Arya Rao on LinkedIn to discuss her research more in-depth, and hopefully form a professional relationship with her. It is my belief that undergraduate students should attend conferences like this one, because it provided us with an avenue to further understand what research in the world after education consists of. It also allowed us to network with individuals in the STEM field, and make connections between material covered in lecture and how these themes are used in research today. After attending this conference, I feel that I have a better understanding of morphogenesis gradients, gonadogenesis, and the importance of embryo migration patterns.