Effect of Mitosis on Chromosome Pairing in Drosophila melanogaster

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In Drosophila melanogaster chromosomes are paired in most cells. In their 2020 paper, Child made a model that would predict the trend of how chromosomal pairing increases over embryonic development; however pairing levels of real, live embryos increased much more rapidly than the model predicted. I hypothesized that mitosis might contribute to pairing increasing rapidly in the live embryos because the model did not account for it. To determine this, I bred flies that have fluorescent markers on their chromosomes. I took images of their cells directly before and after mitosis and measured the distances between the markers on each chromosome. I did not find that mitosis caused a significant increase in homologous pairing, so now I know further work into mitosis does not need to be done.

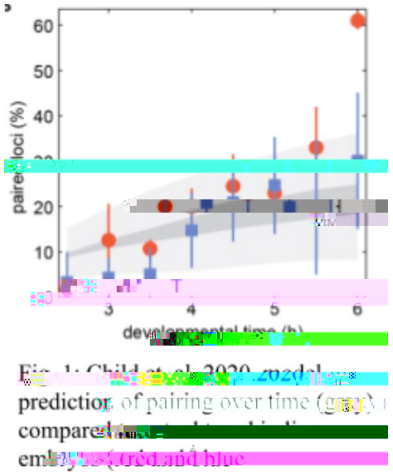
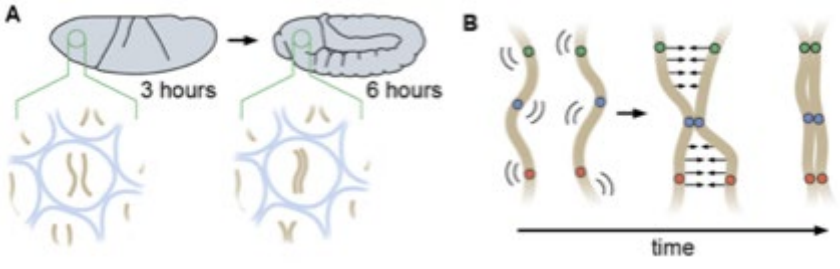


Fig. 1: Child et. al. 2020 model prediction of pairing over time (grey) compared with embryos (red and blue

model predicted (see fig.1). Child's paper left off with the question of what could contribute to the more extreme trend we see in live embryos that the model does not consider. I predicted that mitosis might provide the newly divided cells a good opportunity to find their homologous pairs and that I would see a steeper increase in pairing directly after cell division.



Child et. Al. 2020

In order to determine if mitosis led to an increase in homolog pairing, I first had to breed embryos that would contain the necessary components of the fluorescent markers that would allow us to visualize homologous chromosomes. I made a genetic cross of UAS, DSCP, MS2; E,11 virgin females and Nullo gal4; UAS PP7 males and collected stage 5 (or cycle 14) embryos. The UAS, DSCP, MS2; E,11; Nullo gal4; UAS PP7 embryos had the genes for RNA stem loops which are made by RNA polymerase, and portions that bound to both the RNA stem loops and either red or green fluorescent proteins. these appeared on both homologs of polytene position 38F, which is a known pairing site (see figure 2). I then observed these live embryos using the confocal microscope and took videos of their early development from 130 minutes (about 2 hours) old to 230-250 minutes (about 4 hours) old. Because the fluorescent signal

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References:

Live imaging and biophysical modeling support a button-based mechanism of somatic homolog pairing in Drosophila Child et. al. 2021 eLife 2021;10:e64412 DOI: 10.7554/eLife.64412

Mitotic domains reveal early commitment of cells in Drosophila embryos VICTORIA E. FOE
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