Recombination Rate Plasticity and Interchromosomal Effect in *Drosophila Pseudoobscura*

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Background

- Extrinsic and intrinsic factors such as temperature, age, sex and starvation can generate 'plastic' responses in recombination rate.
- Heat stress and aging impact on broad-scale recombination rate variation in multiple regions of the genome.
- We included different strains with varying chromosomal arrangements that can lead to Interchromosomal effect (ICE). In general, recombination rates increase with these inductive stresses. However the effects are unresolved.
- Here, the empirical genetic work done in *Drosophila pseudoobscura*, will form a basis for comparative recombination rate data.
  - Our model system has different chromosomal arrangements on Chromosome 3.

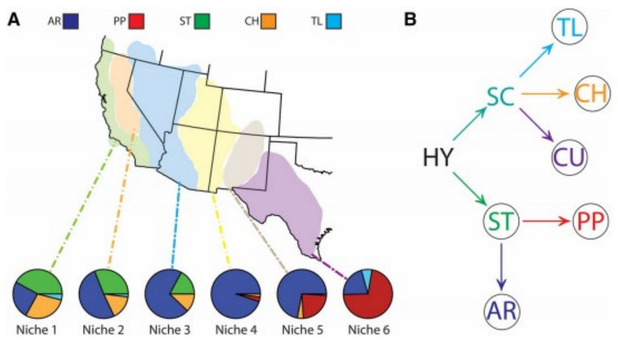
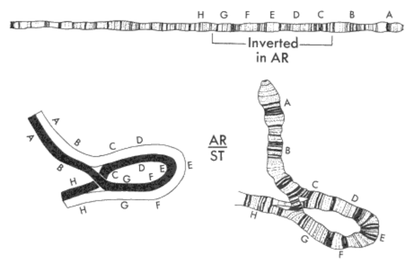
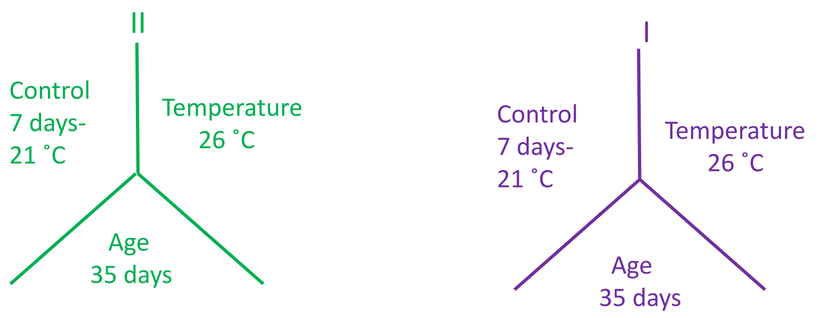


Figure1: Chromosomal arrangements in *D. pseudobscura* adapted from Fuller et al., 2011



Methods

Experimental Design



Indicates experiments with the same chromosomal arrangement
e.g. treeline – treeline

Indicates experiments with different chromosomal arrangement
e.g. arrowhead – treeline

Cross design

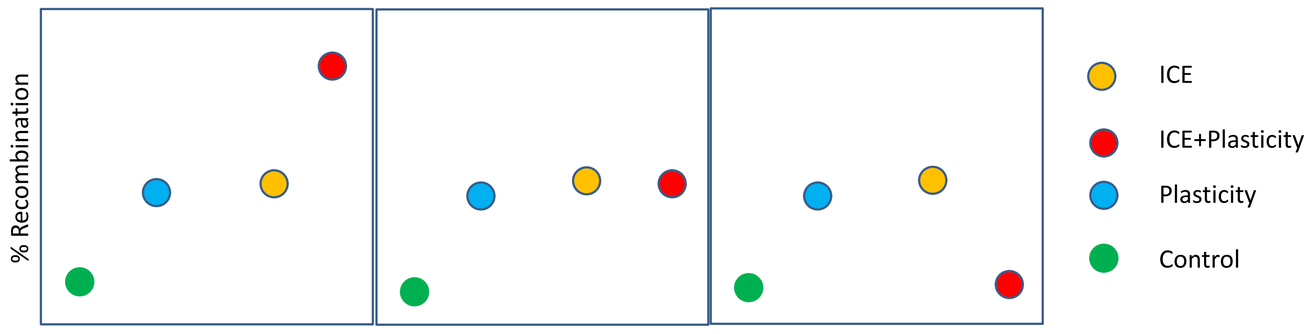
Tl265 (WT) ♂ X sd-y ♀

sd-y X TL265 ♀ X TL265 (WT) ♂

MV2-25 (WT) ♂ X sd-y ♀

sd-y X MV2-25 ♀ X MV2-25 (WT) ♂

Expectations



Results and Discussion

Effect of Temperature and ICE

	ICE	ICExAge/Temp	Control	Age/Temp
Expected	32.5	32.5	32.5	32.5
Observed ICExTemp	12.3	33.3	25.7	12.6
Observed ICExAge	15.6	19.4	14.0	16.7

- Results indicate a additive in the recombination rates due to temperature; the heterokaryotype control and homokaryotype temperature were largely significantly different.

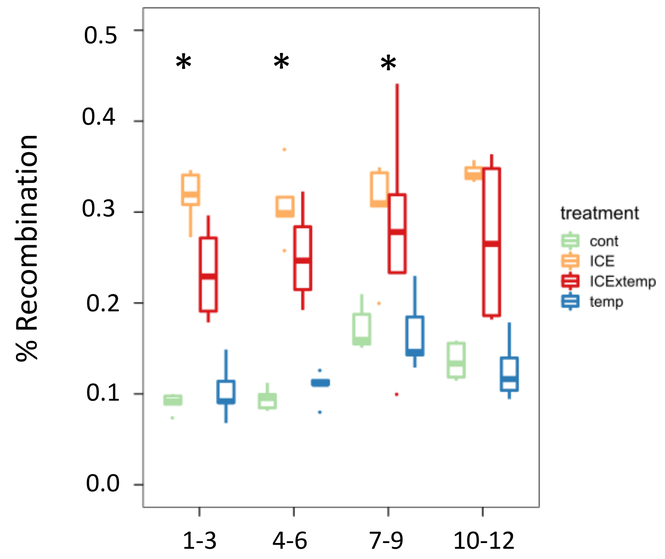


Table 2: Statistical model for total recombination rate

	Df	Deviance	Df	Dev	Pr
Treatment	3	517.42	72	110.79	**2.2e-16**
Day	3	30.39	69	80.40	**1.144e-06**
Day:Treatment	9	19.75	60	60.65	**0.0195**

Effect of Maternal age and ICE

- Results indicate a saturation in the recombination rates due to age; the heterokaryotype control and homokaryotype age were largely similar in time points except for 1-3 days post-mating.

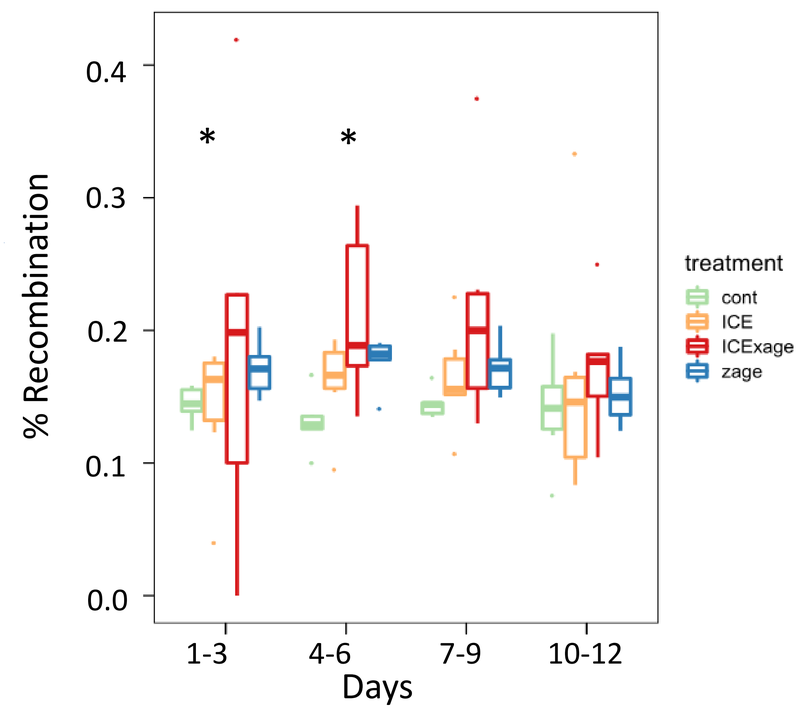


Table 3: Statistical model for total recombination rate

	Df	Deviance	Df	Dev	Pr
Treatment	3	30.4537	96	82.31	**1.108e-06**
Day	3	3.3917	93	78.64	0.3351
Day:Treatment	9	5.3702	84	73.269	0.8009

Conclusion & Future Directions

1. Recombination rate varied based on the combination of treatments. ICE on temperature plasticity generate an additive effect on recombination rates while maternal age stabilizes the recombination when combined with the ICE effect.
2. Different chromosomal rearrangements might result in ectopic recombination and increase in crossover control steps, leading to increase in recombination rates. Comparison between the regulative pathways might explain interaction between crossover control processes. .

References

1. Grell, R. F. (1978). A comparison of heat and interchromosomal effects on recombination and interference in Drosophila melanogaster. *Genetics*, *89*(1), 65-77.
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4. Joyce, E. F., & McKim, K. S. (2011). Meiotic checkpoints and the interchromosomal effect on crossing over in Drosophila females. *Fly*, *5*(2), 1001059.