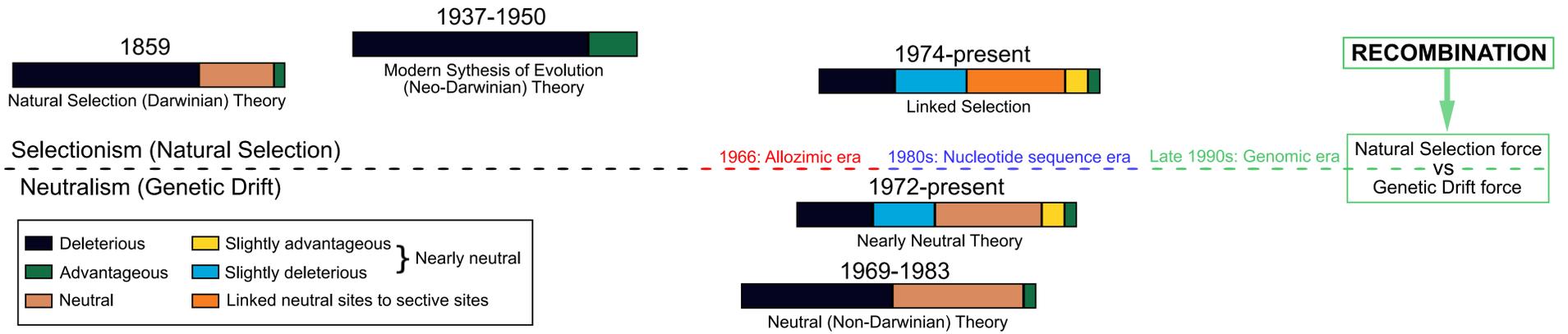


The Hill-Robertson interference and linked selection blocks as the new paradigm of selection unit

INTRODUCTION: Linked selection as a selectionist alternative to Neutral Theory



Linked selection models

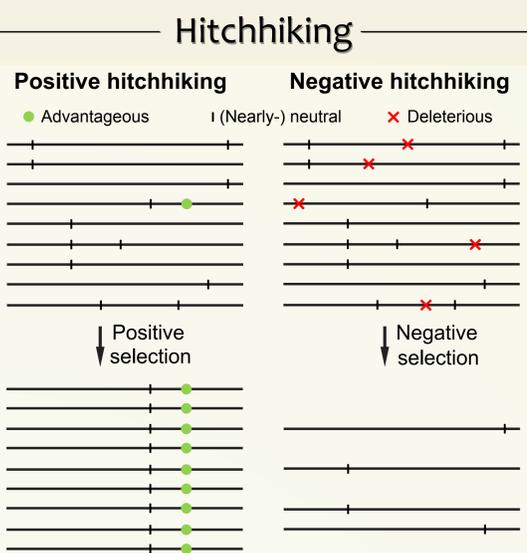


Figure 1: Effects of both positive and negative hitchhiking.

Both models predict a reduction of neutral variability.

Hill-Robertson interference

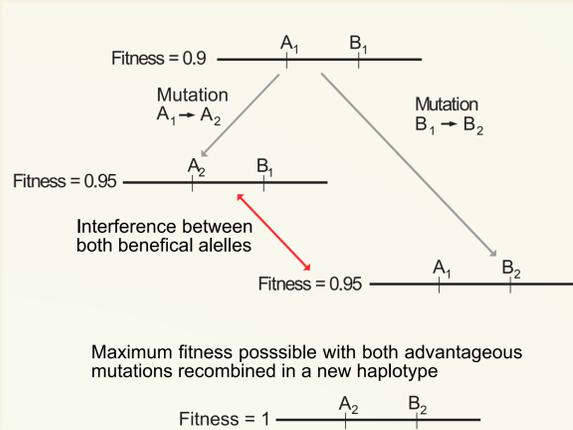


Figure 2: HRI between two advantageous alleles at a low-recombinant genomic region in a finite population.

This model predicts a reduced effectiveness of selection with the absence of recombination.

Recombination effects on evolution rate

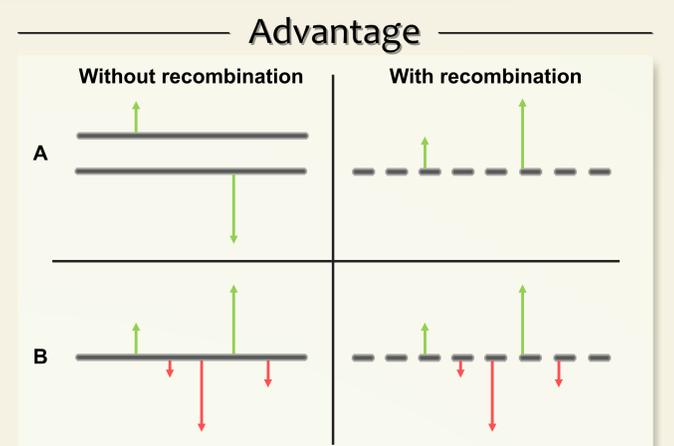


Figure 3: Effect of recombination on reducing the HRI magnitude.

Selection effectiveness increases as recombination increases.

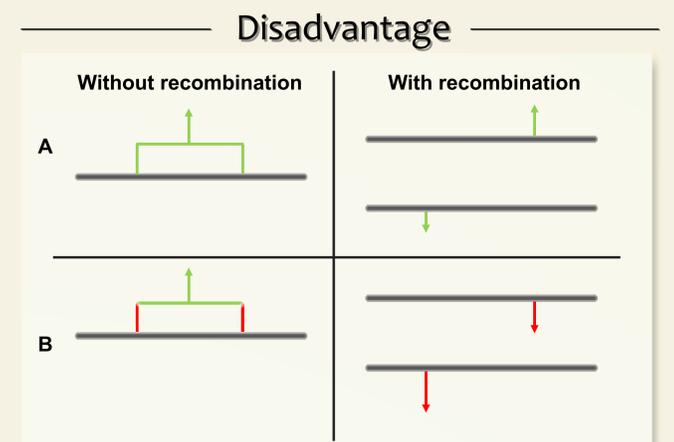


Figure 4: Effect of recombination on epistatic interactions.

Selection effectiveness decreases as recombination increases.

Role of introns at local scale HRI

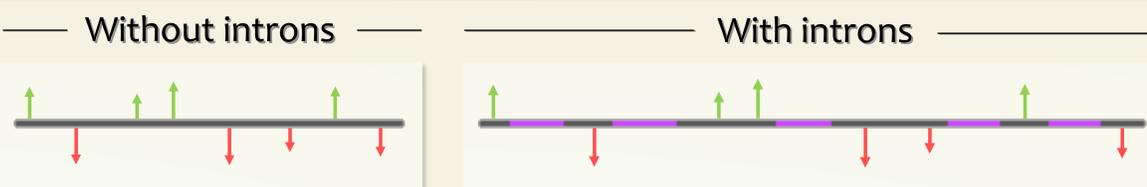


Figure 5: Effect of introns on recombination between multiple selective sites in a low-recombining region.

Introns might be viewed as modifiers of recombination that reduce intragenic HRI effects, providing a possible evolutionary explanation to the origin and maintenance of introns.

Linked selection blocks: new units of selection

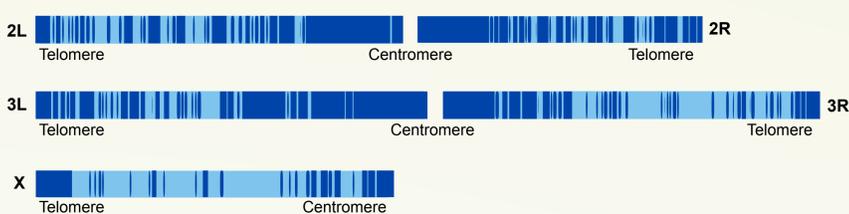


Figure 6: Distribution of linked selection throughout *Drosophila melanogaster* genome.

NLSB Unit of selection: freely segregating site.
Molecular evolution of new mutations is the result of all forces acting on the site.

LSB Unit of selection: block of linked sites.
Variation patterns result from the conjunction of all forces acting on each co-segregating site.

CONCLUSIONS

If the recombinational landscape is a fixed and optimized genome property, we expect to find opposed (i) variation patterns, (ii) epistatic effects on fitness, (iii) intron distribution and (iv) evolution rates at different genomic regions:

NLSB

- Large numbers of sites undergoing weak selection.
- Absence or light epistatic positive effects on fitness.
- More and larger introns to facilitate the reduction of HRI.
- Higher evolution rates: these regions will evolve faster.

LSB

- Several alleles undergoing strong selection.
- Complex and strong epistatic positive effects on fitness.
- Less and shorter introns to avoid loss of LD.
- Lesser evolution rates: these regions will evolve slower.

Key references