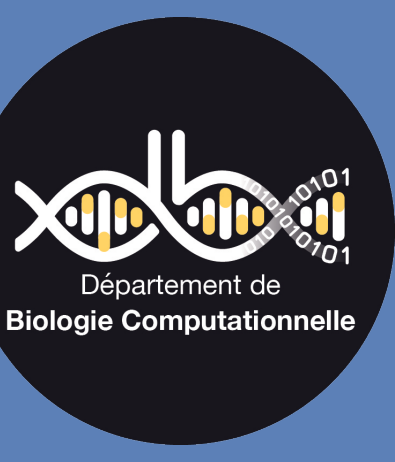




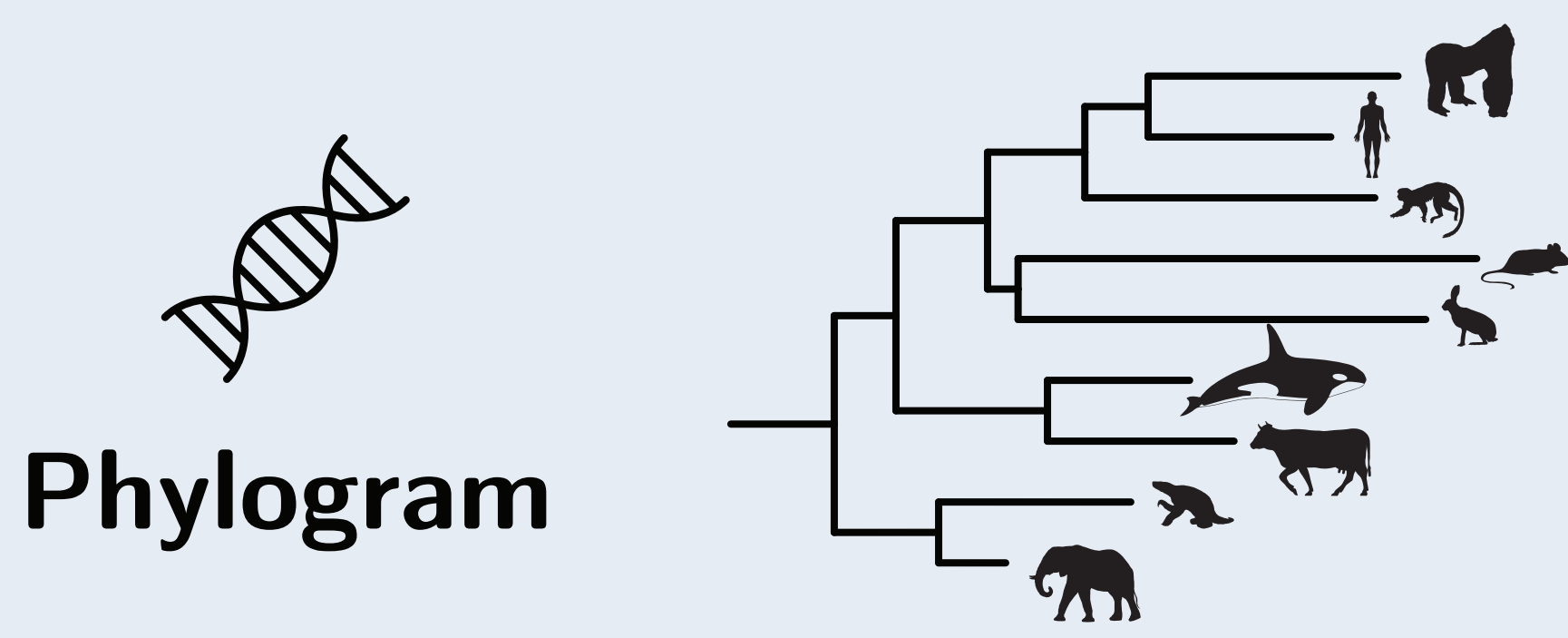
# Chronograms or Phylograms for Phylogenetic Comparative Methods?



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Phylogram

• Phylograms are in unit of substitutions per site,  $2n-3$  free parameters for  $n$  species.

• Phylograms are usually derived from DNA sequence divergence.

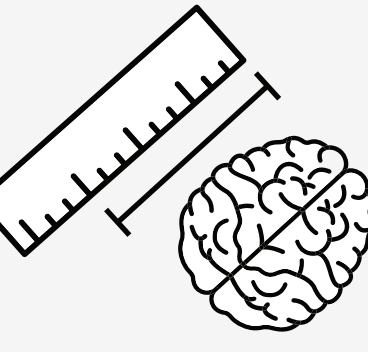


Chronogram

• Chronograms are in unit of time. Ultrametric tree,  $n-1$  free parameters for  $n$  species.

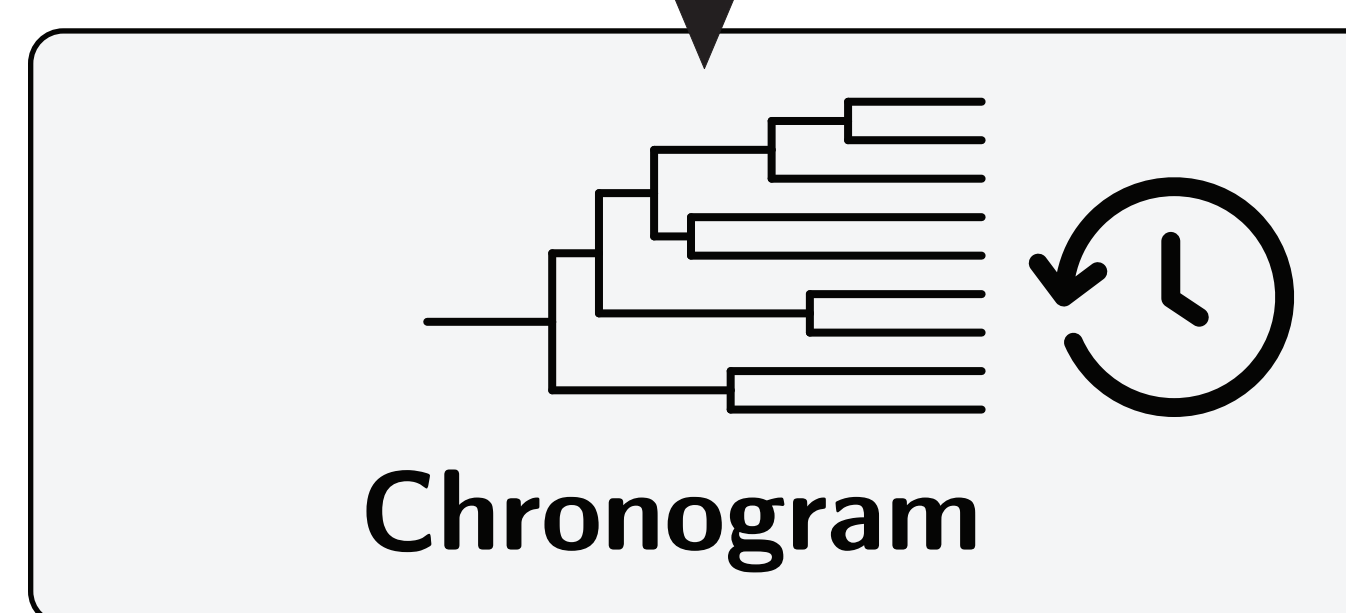
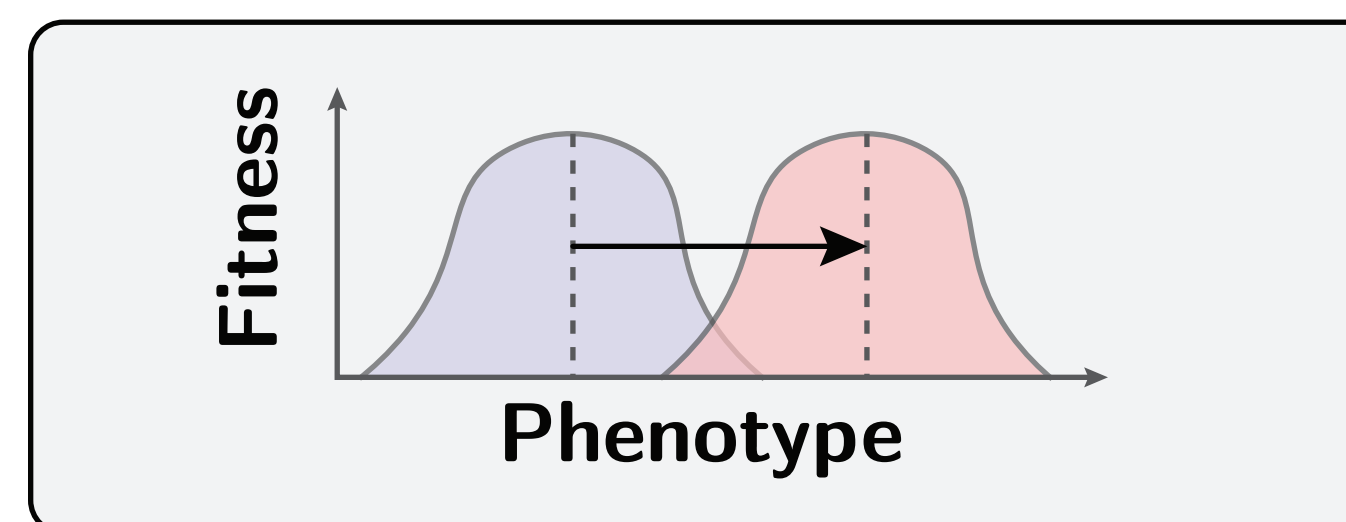
• Chronograms are usually derived from a phylogram (relaxed molecular clock, fossil calibrations, ...).

## Trait evolution is exclusively studied on chronograms? Why not phylograms?



### Trait tracking a moving optimum

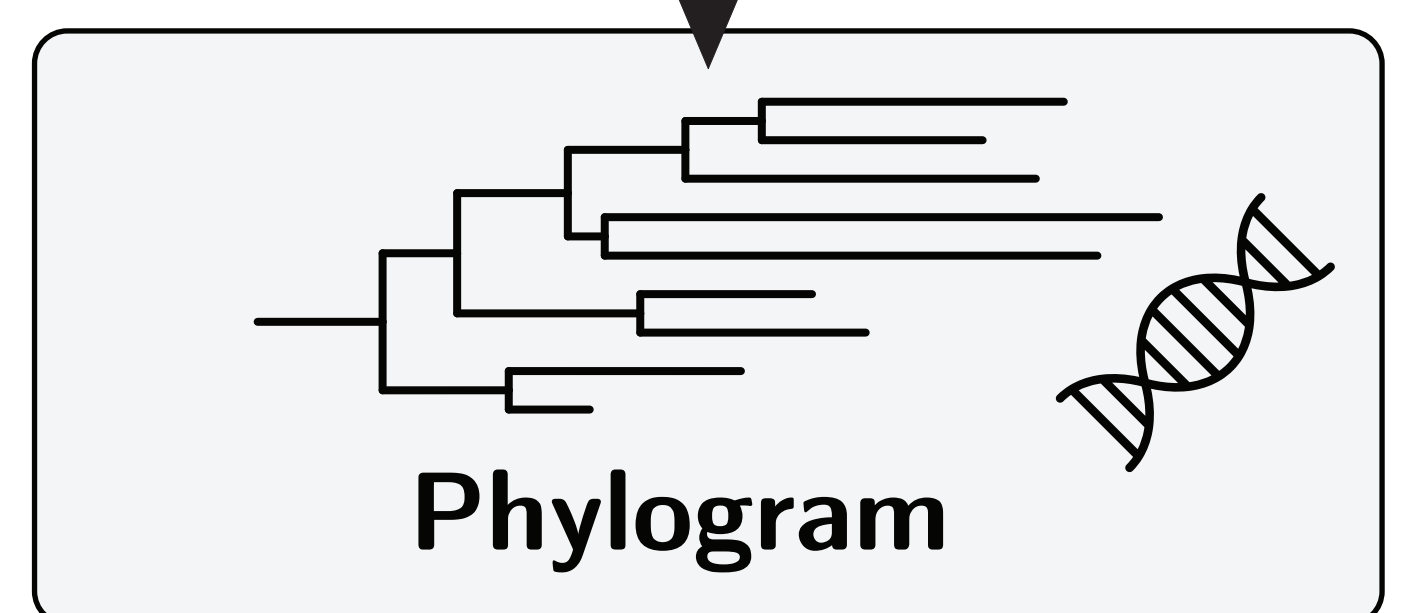
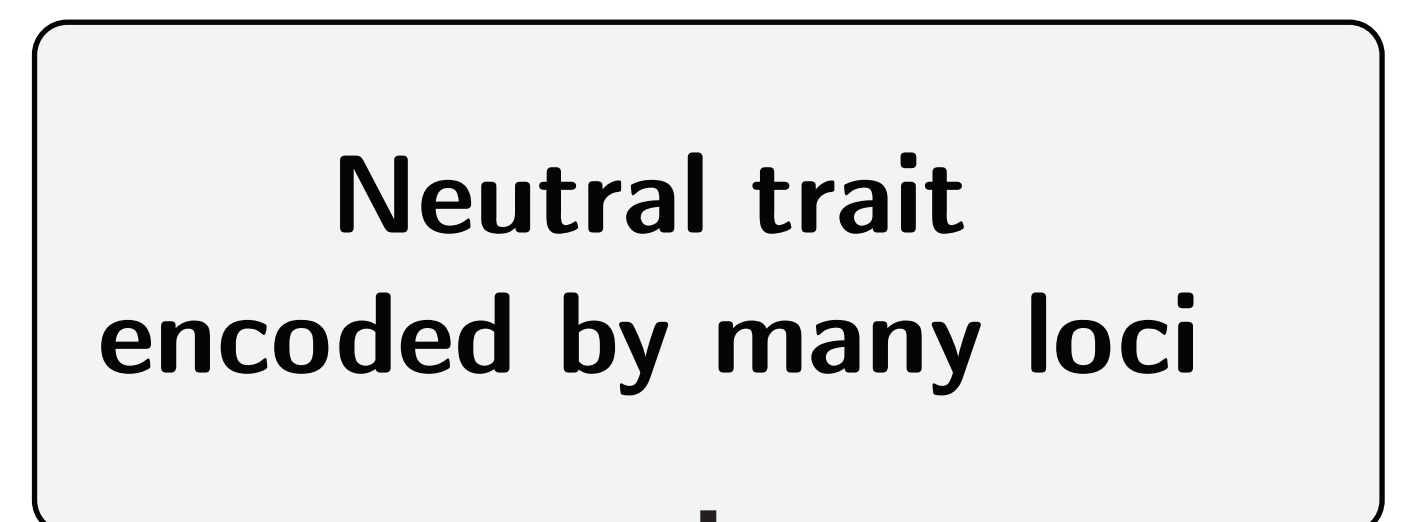
Phenotypic divergence is proportional to time of divergence.



A chronogram should better explain trait changes.

### Neutral trait

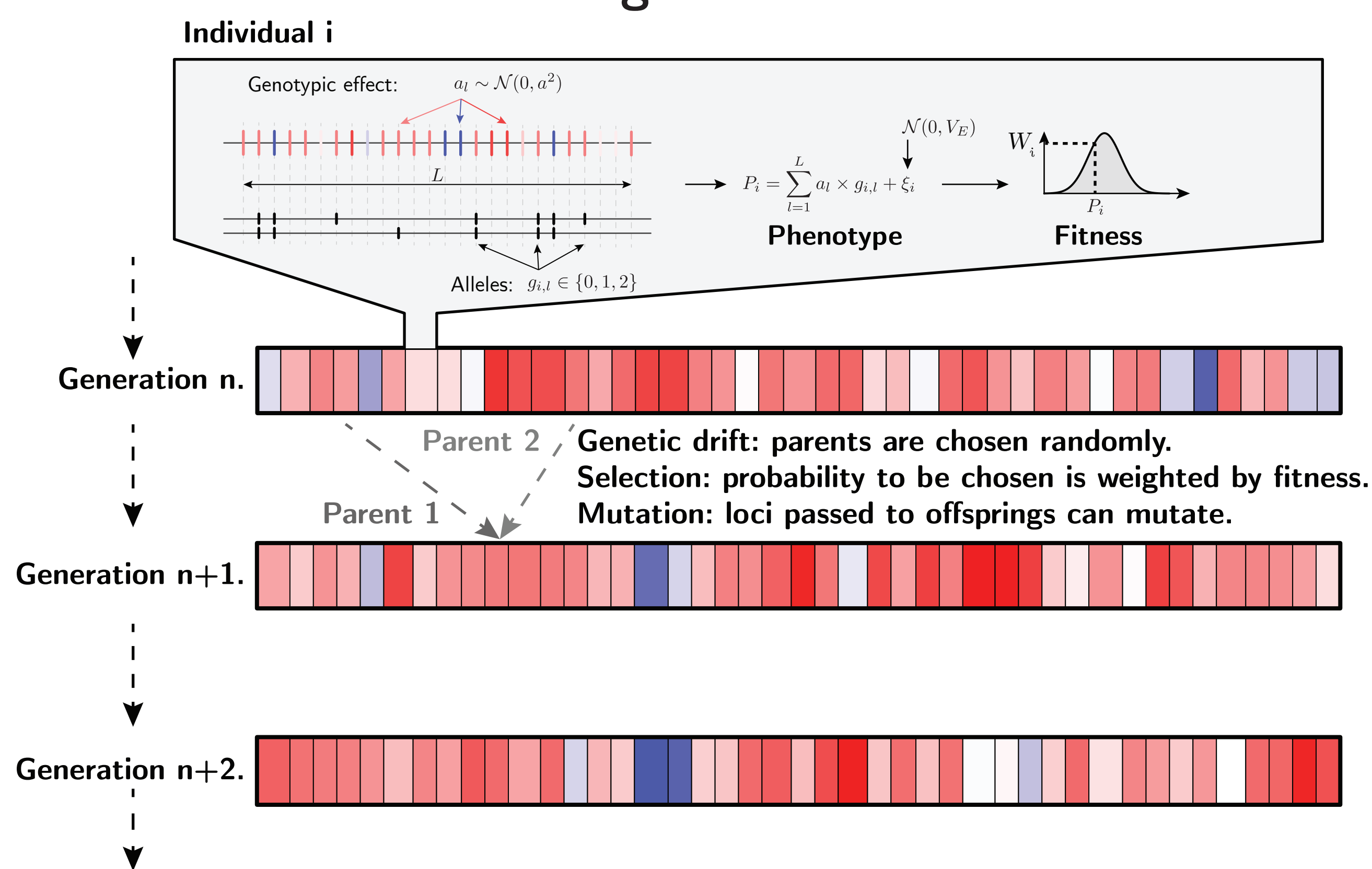
Phenotypic divergence and neutral nucleotide divergence are proportional to the number of generations.



A phylogram should better explain trait changes.

• This can be used to test for the neutral evolution of a trait.

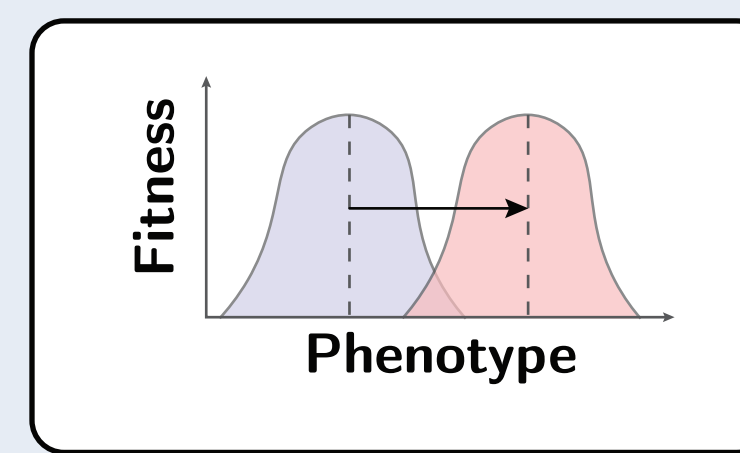
## Building a simulator



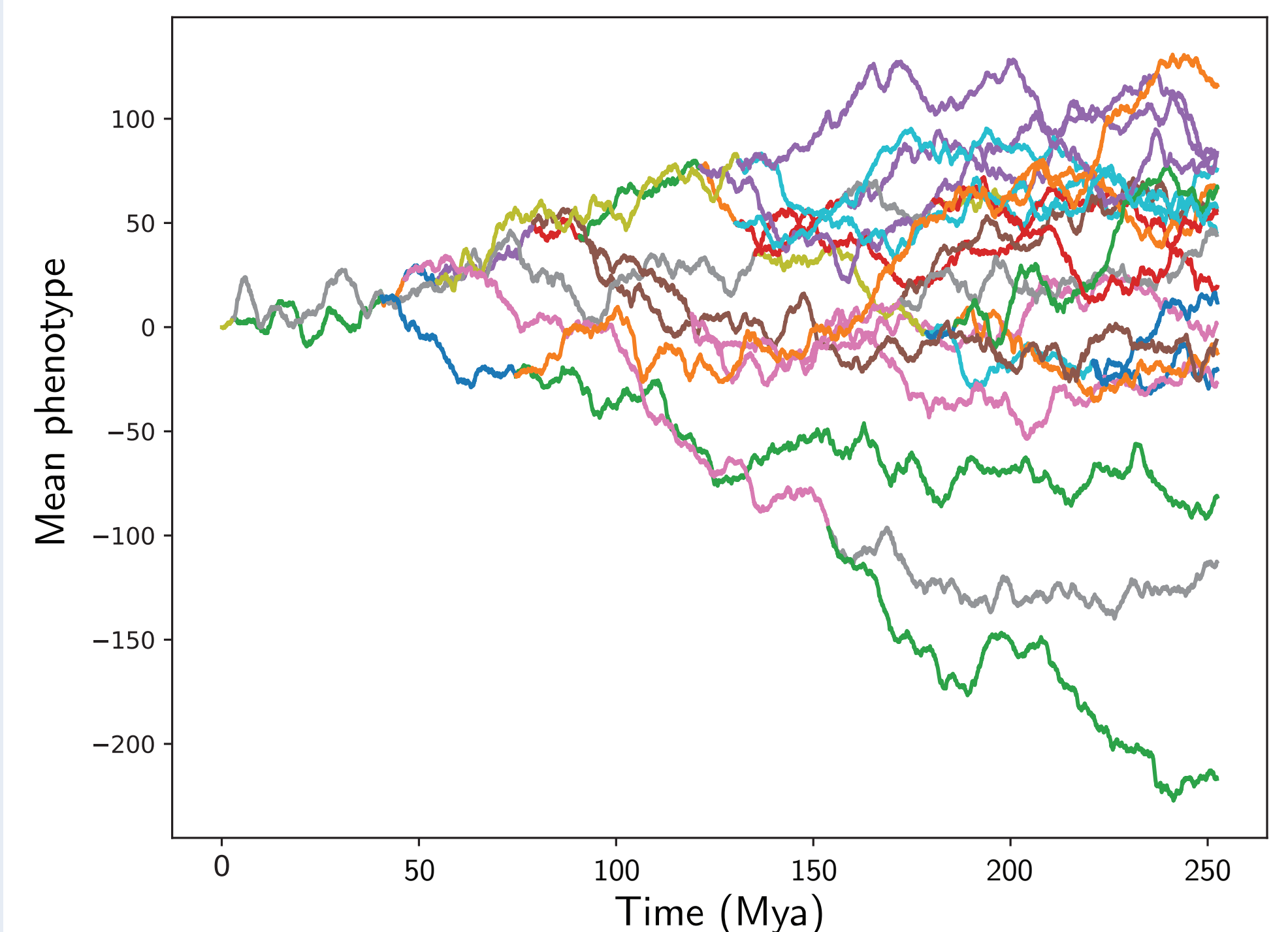
## Simulating different scenarios

**Neutral trait**  
No fitness function.

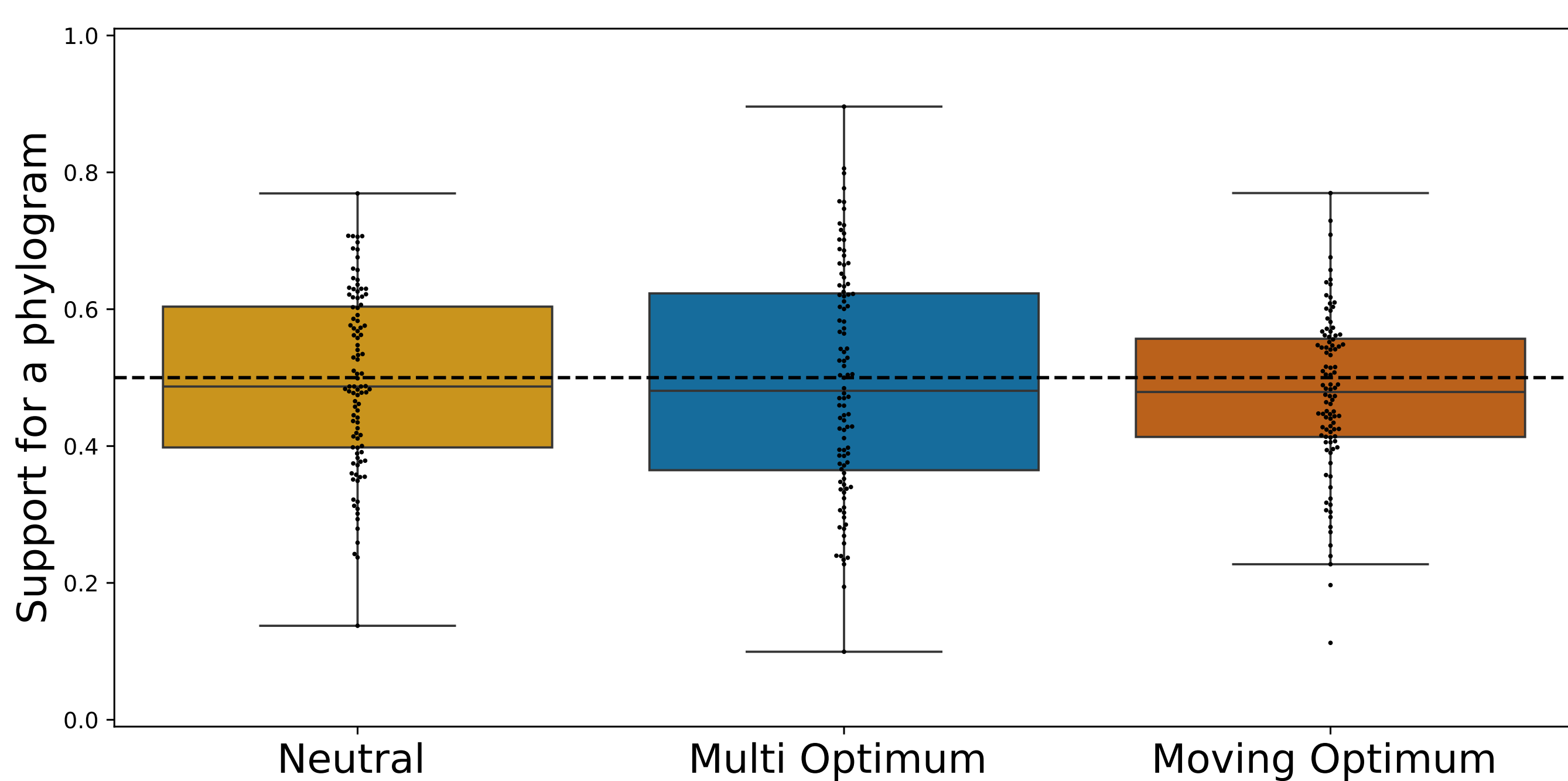
**Moving optimum**  
An optimal value for the trait, changing randomly along the phylogeny.



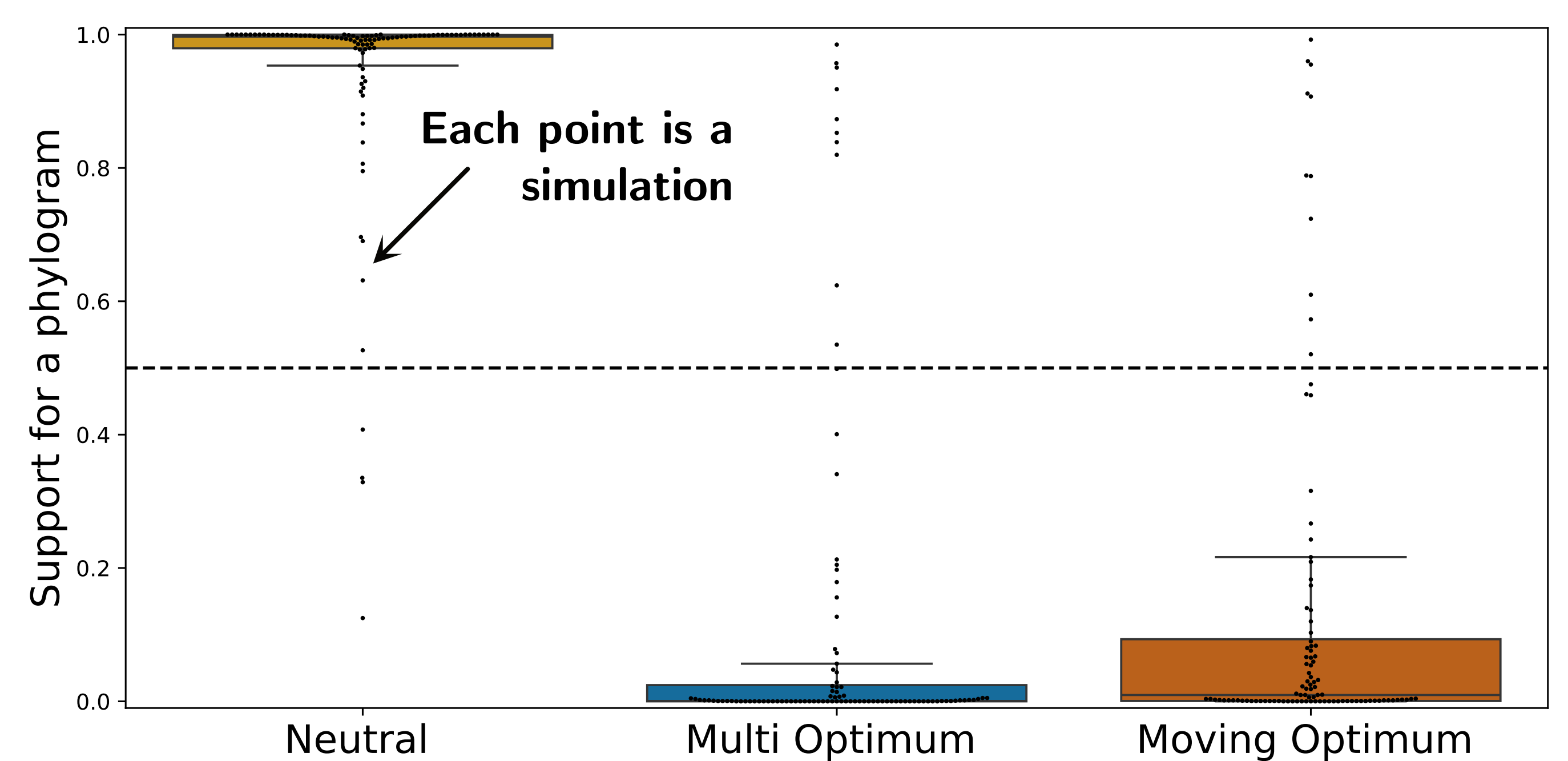
## Running simulations along a phylogeny with changing generation time



## Simulations with constant generation time



## Simulations with changing generation time



# A neutrally evolving trait show support for a phylogram. Phylograms should not be discarded altogether.



revbayes