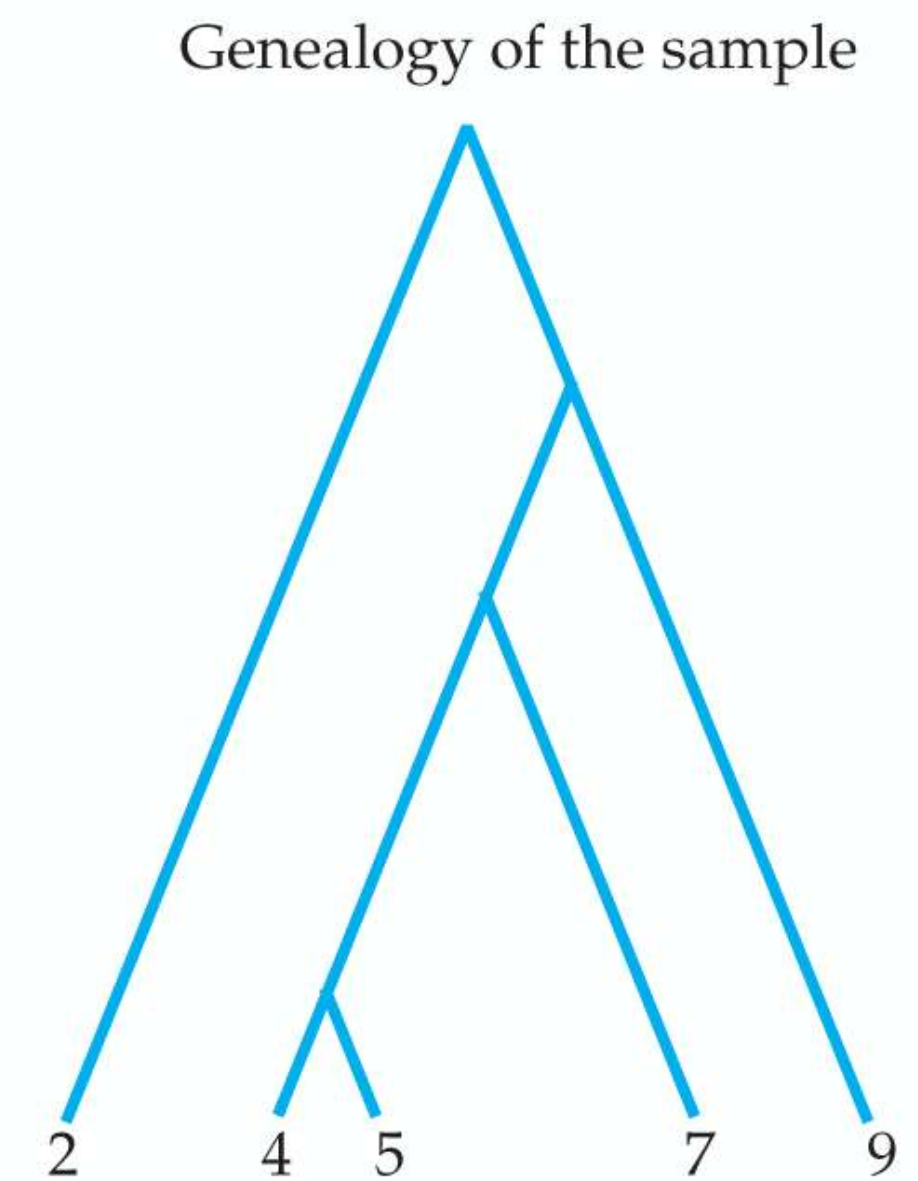
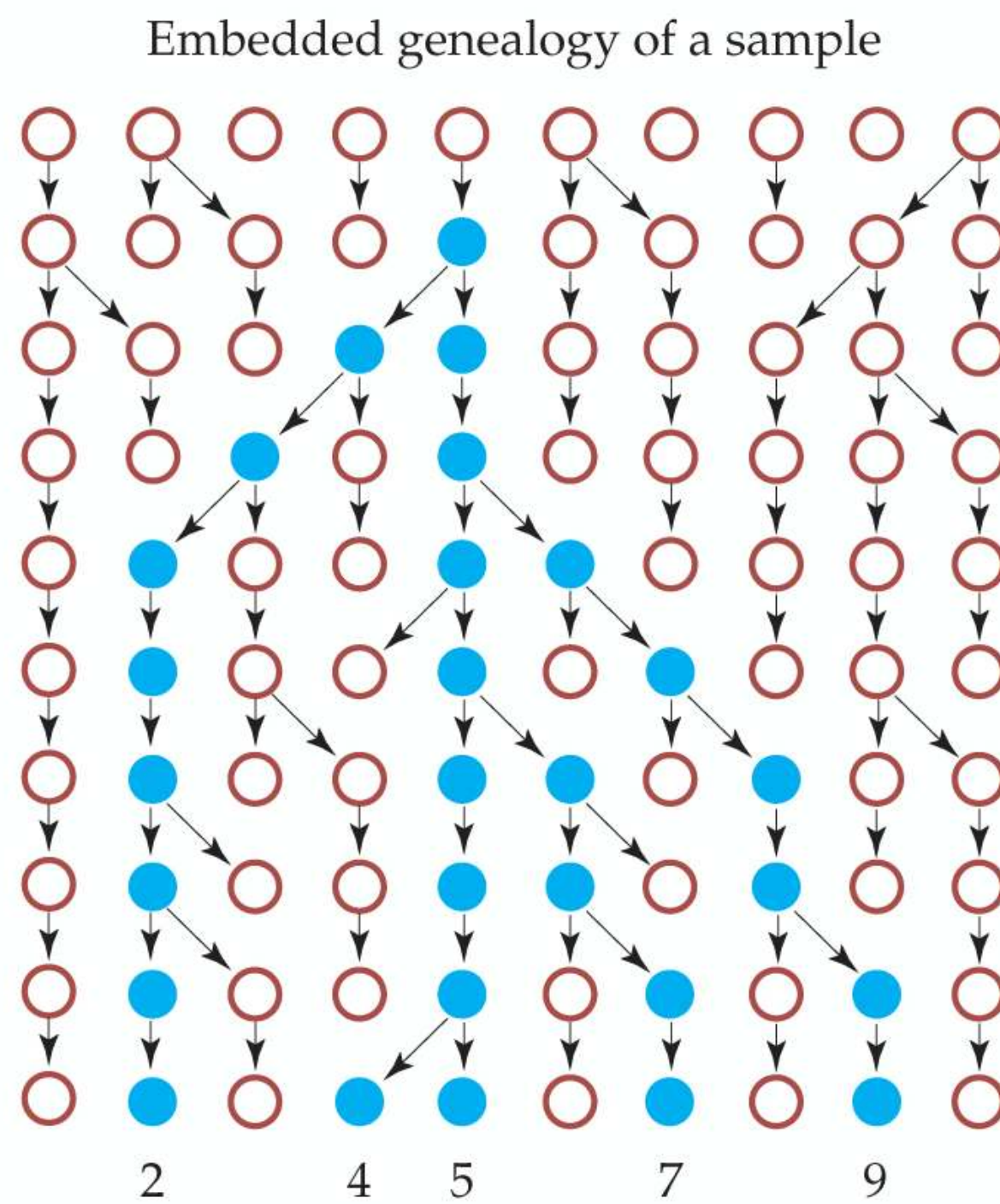
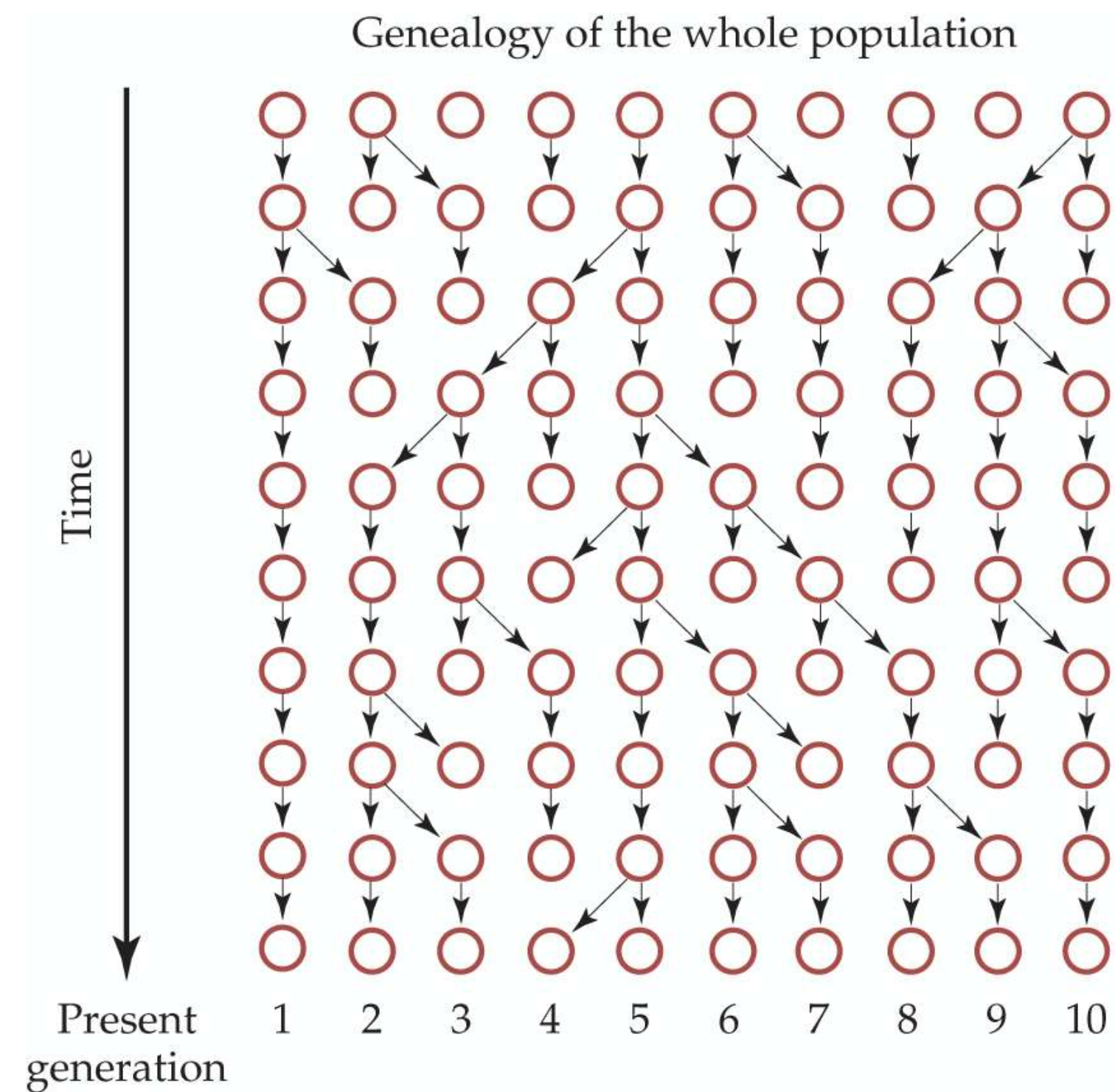


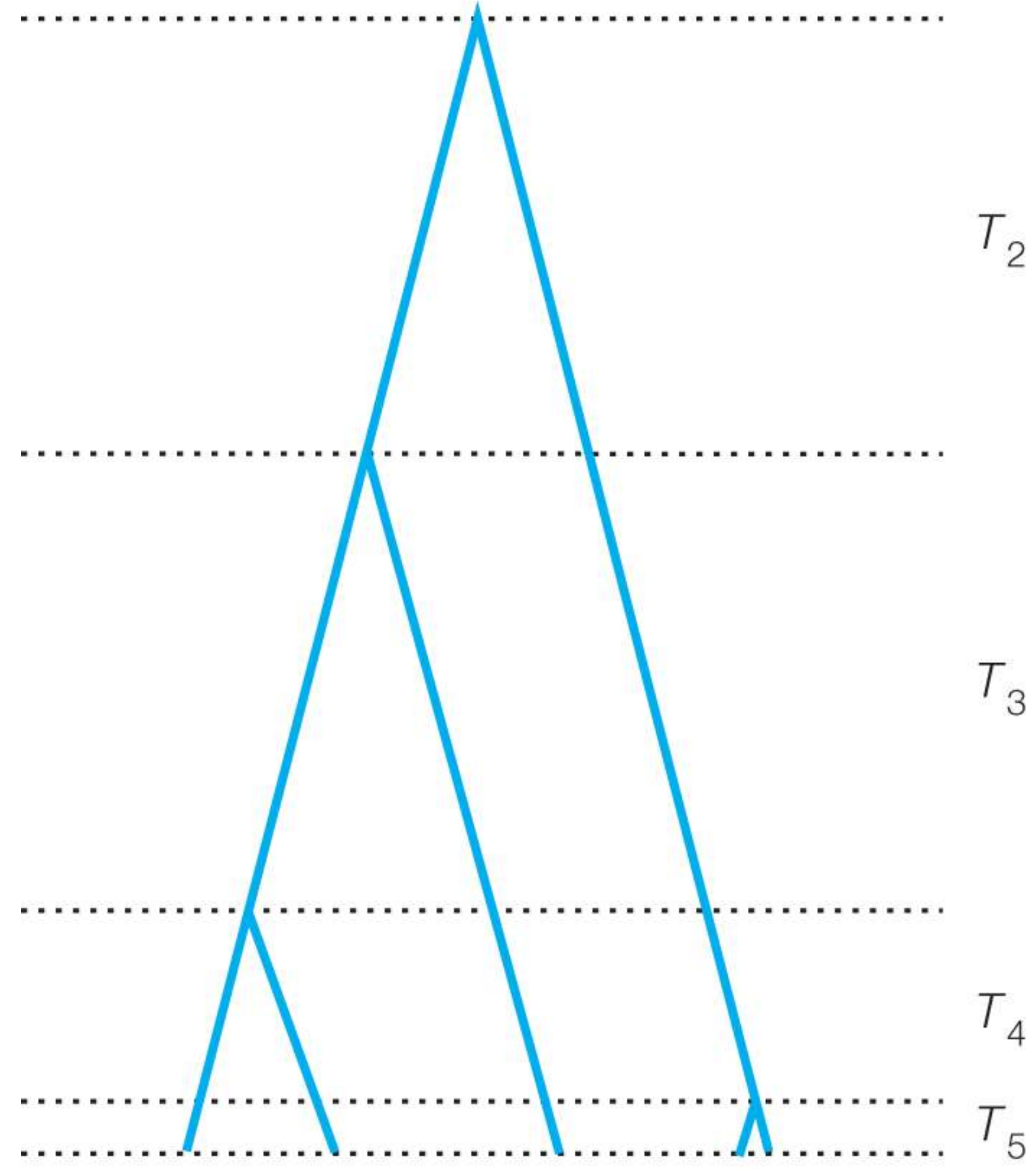
Outline for today

1. Coalescent
2. Multispecies coalescent
3. Multispecies network coalescent
4. (Multiple testing)

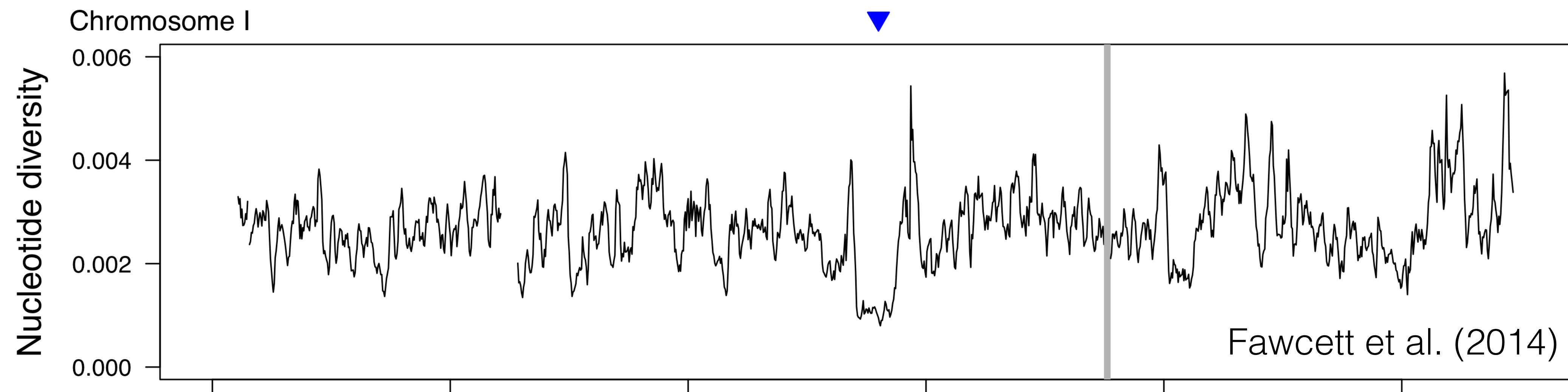
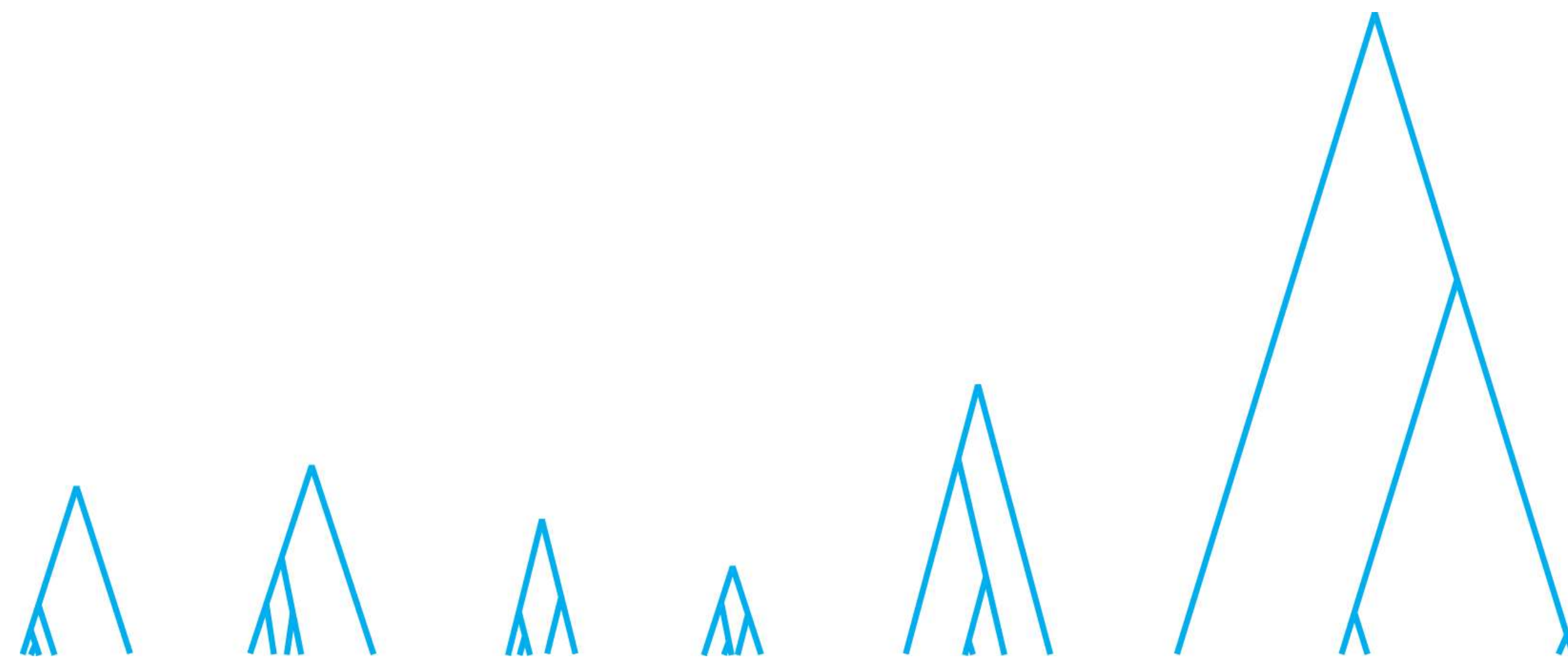
Matthew Hahn
mwh@indiana.edu
@3rdreviewer 

Why do we need the coalescent model?



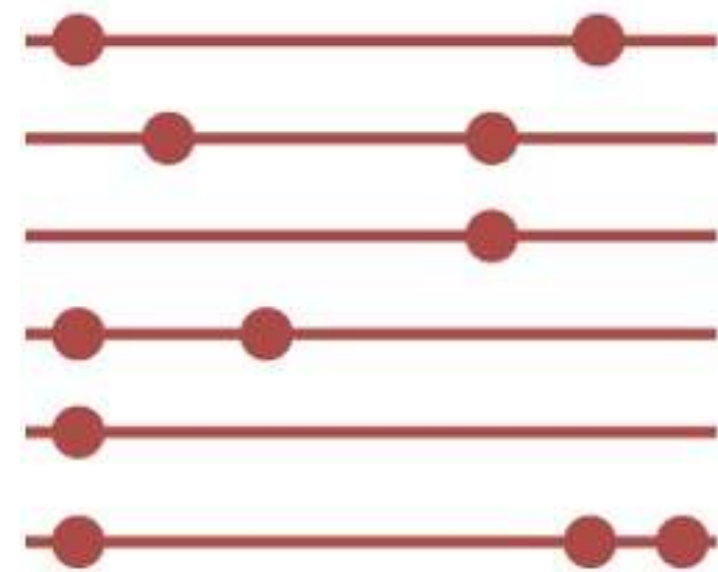
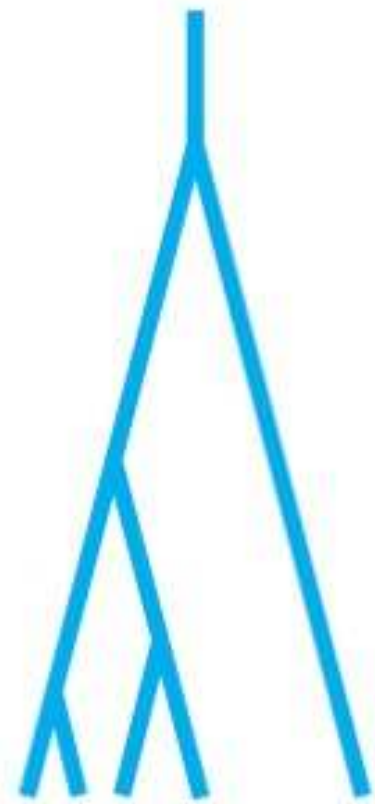




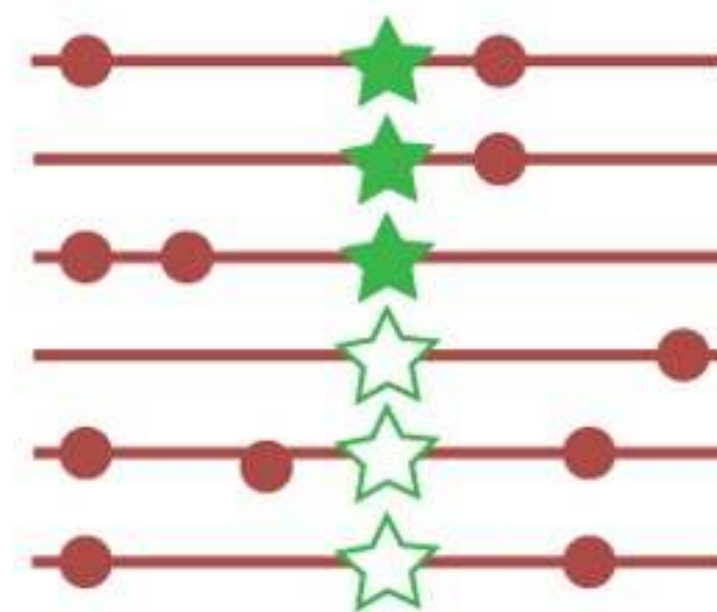
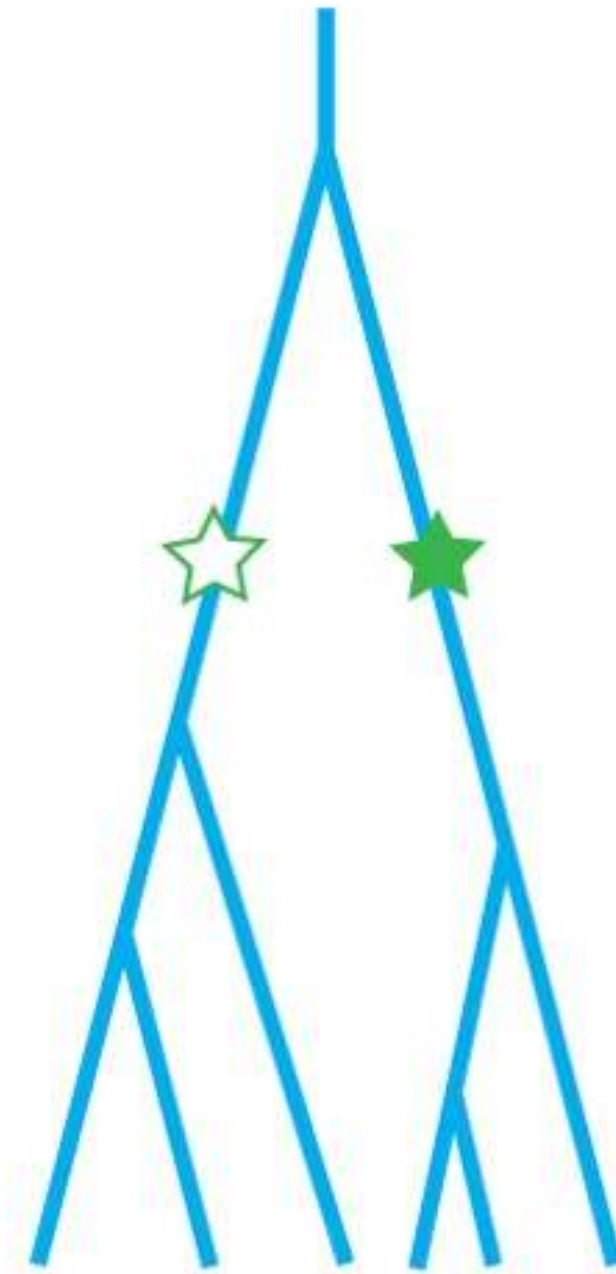


<https://bedford.io/projects/coaltrace/>

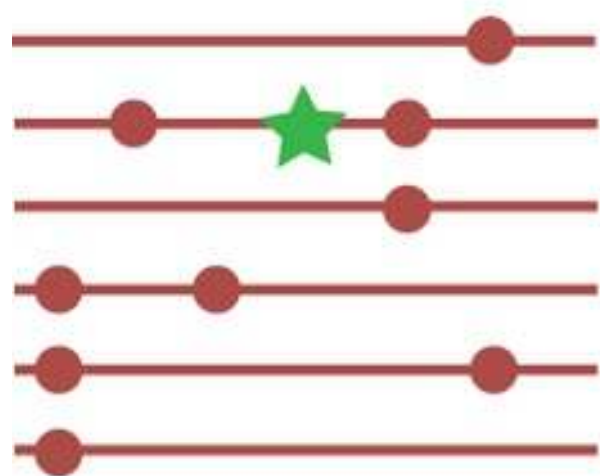
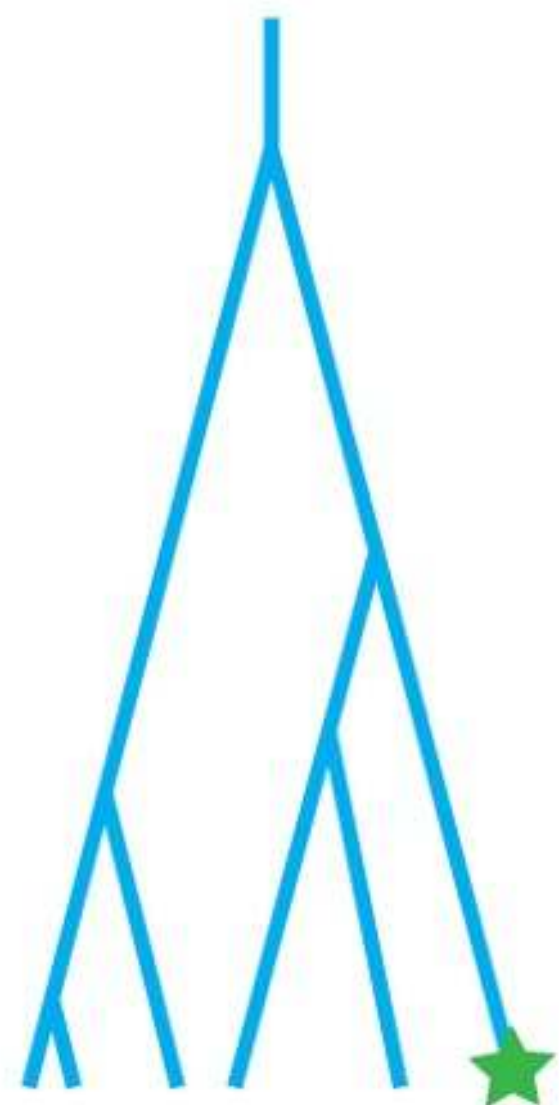
(A)



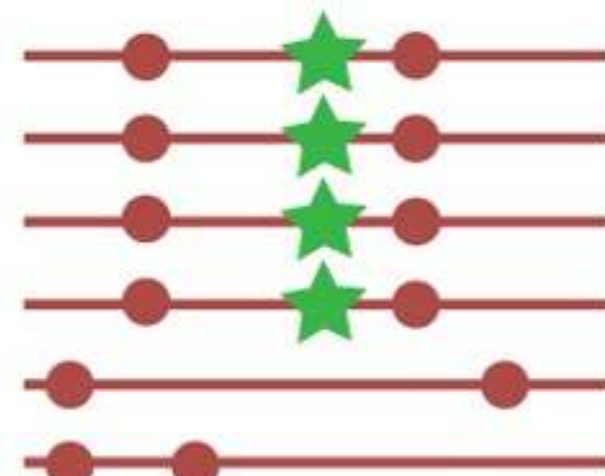
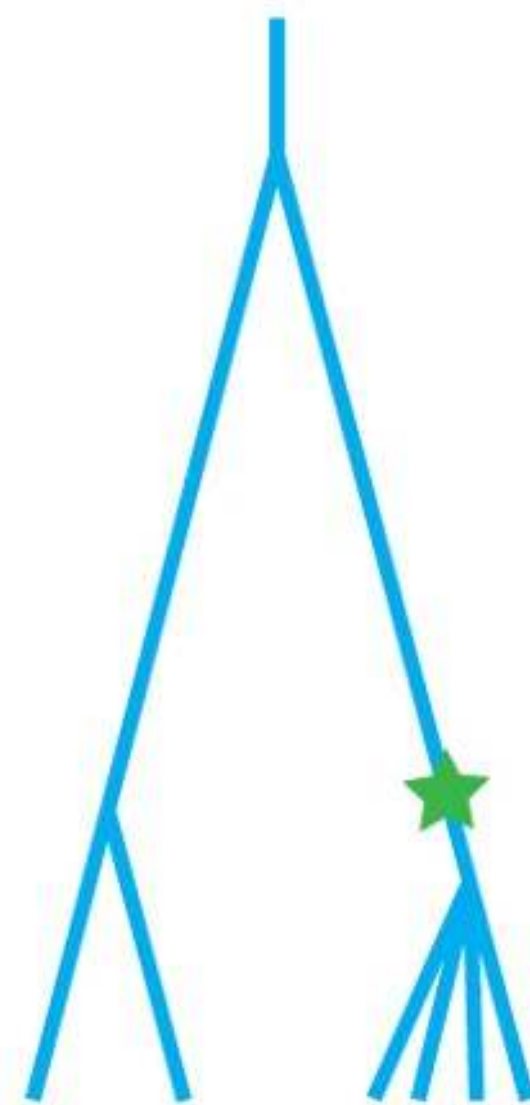
(B)

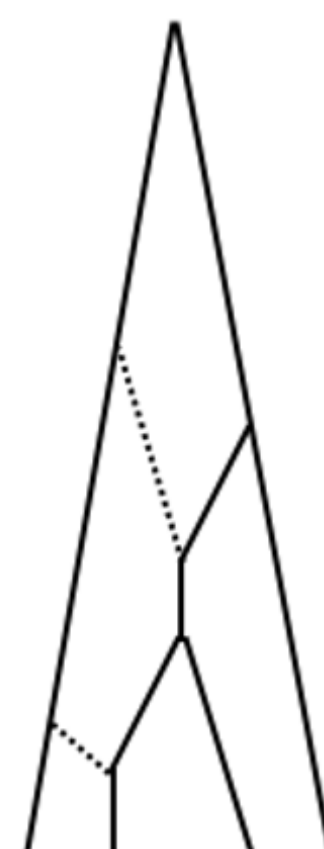
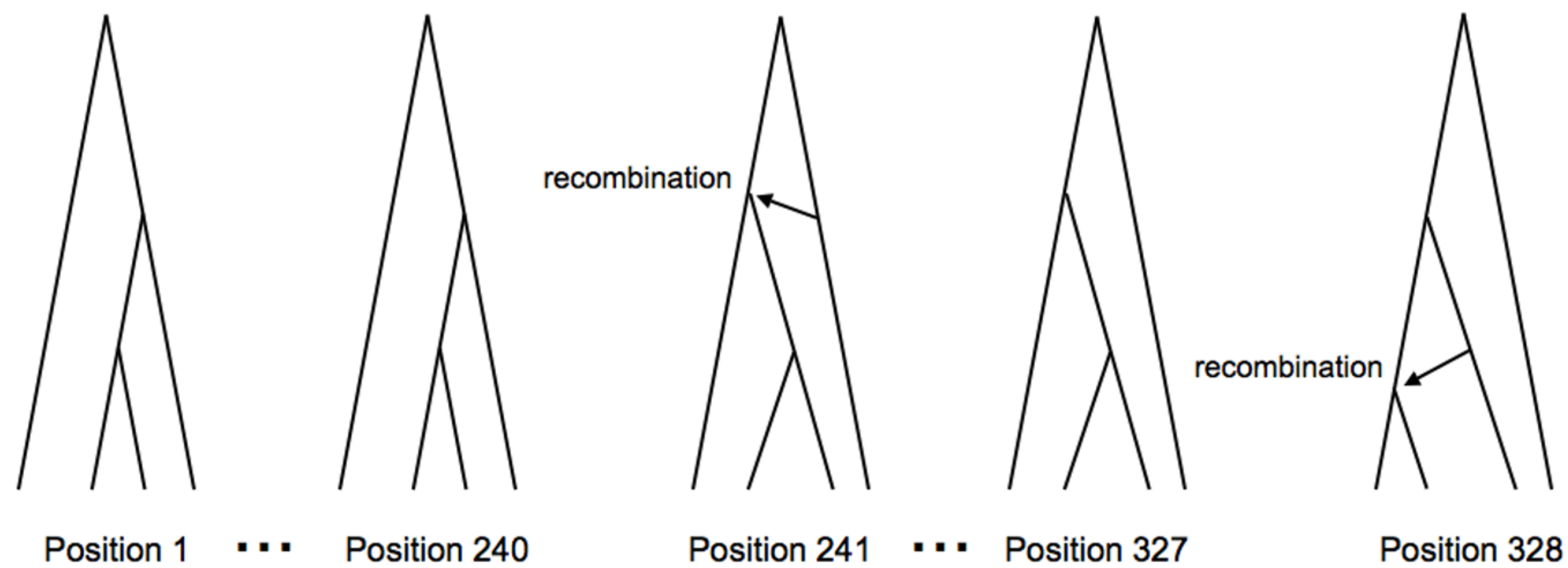


(A)



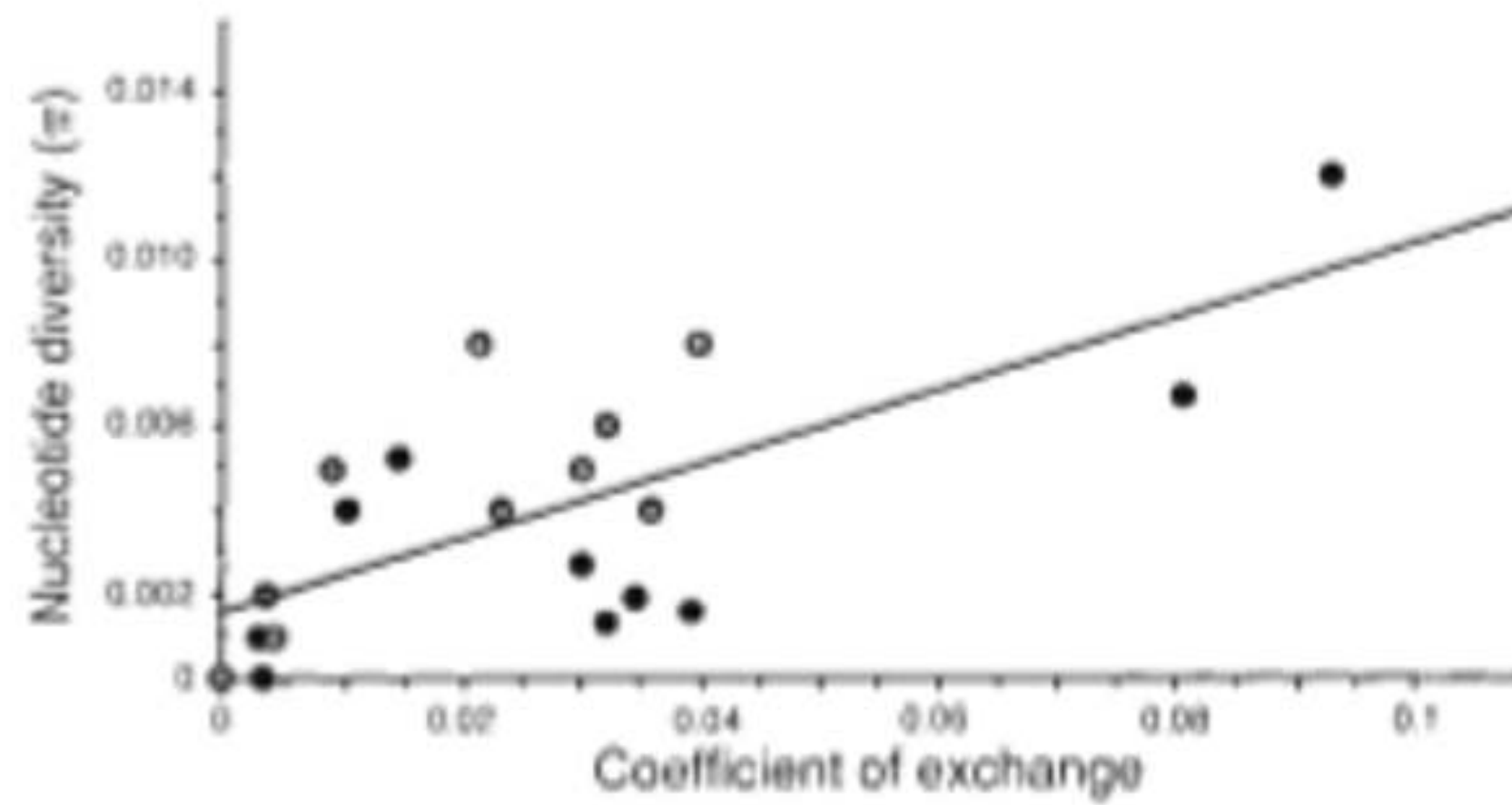
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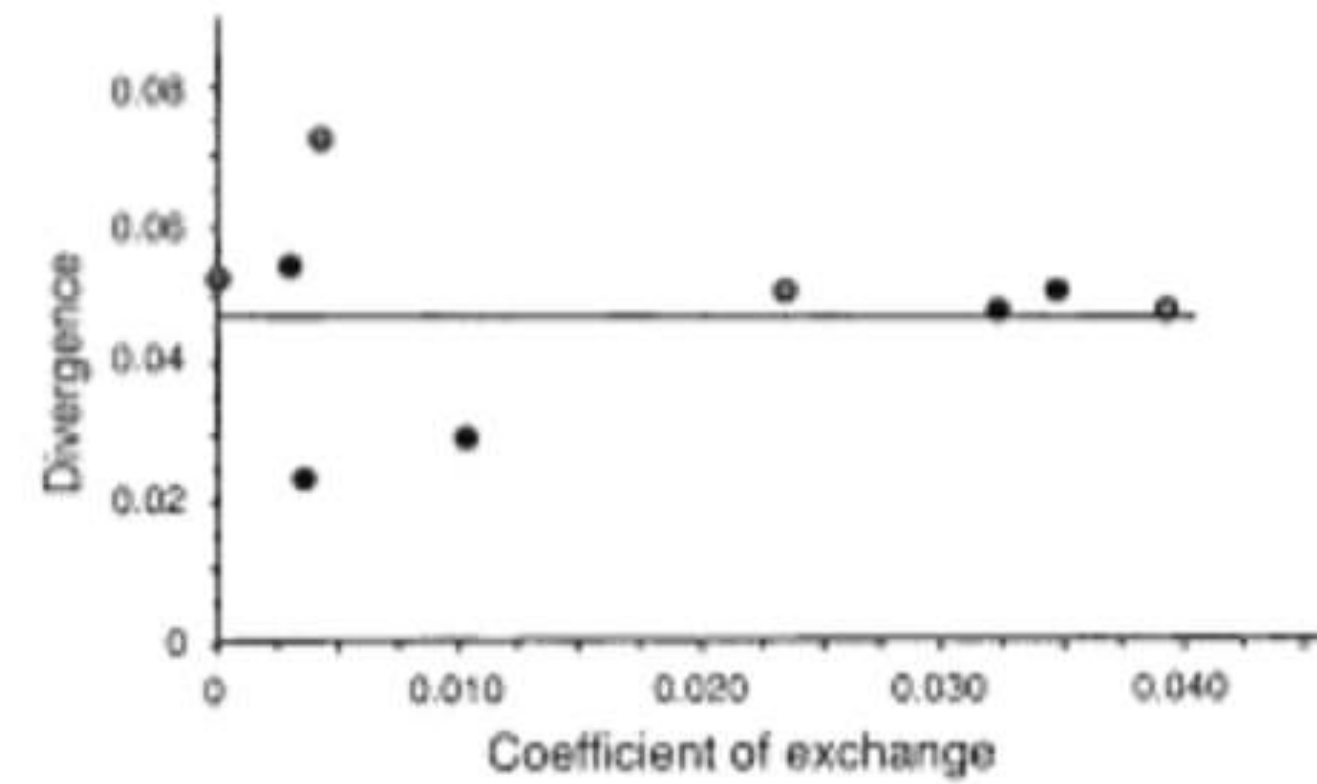


Ancestral recombination graph

Polymorphism vs. recombination



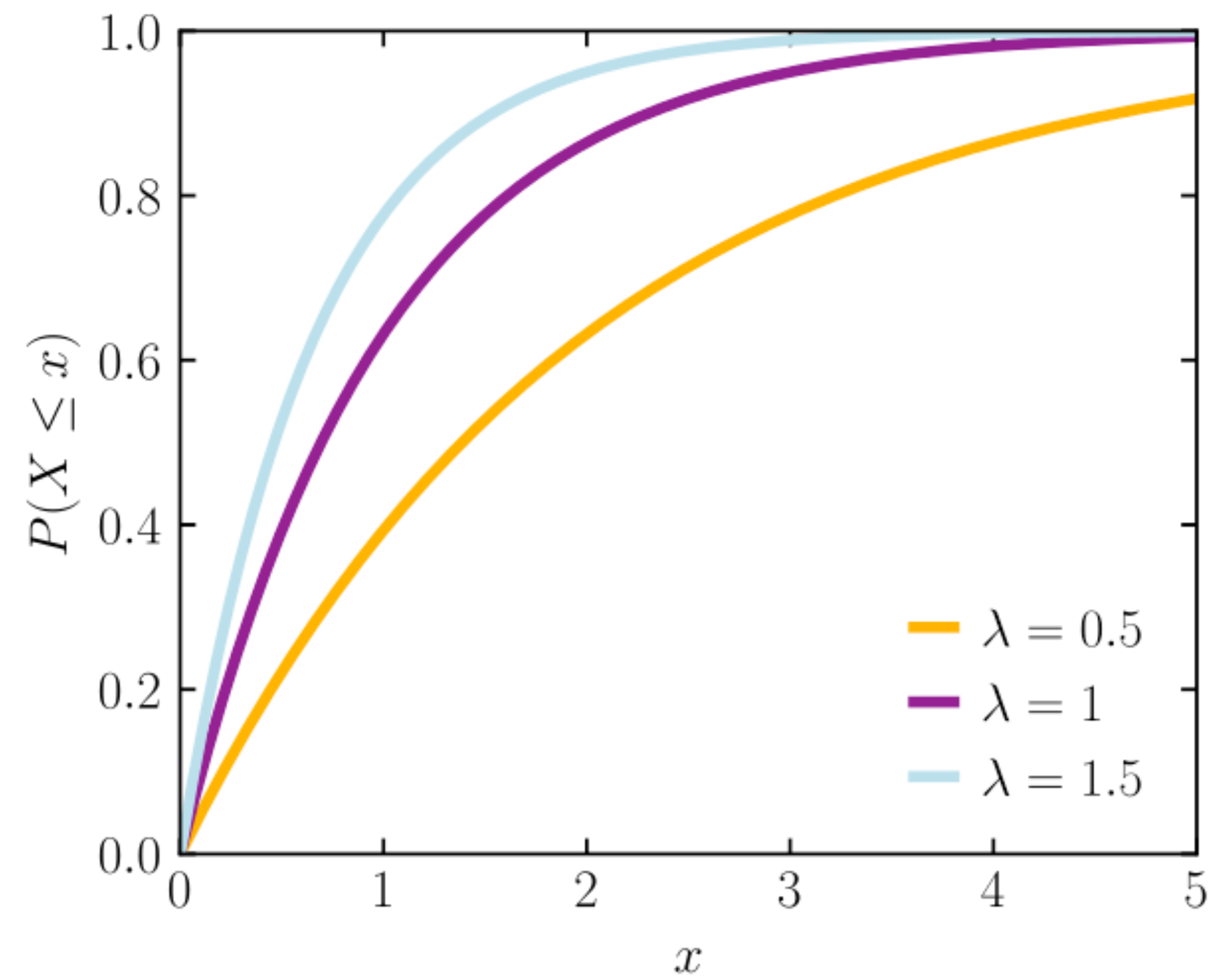
Divergence vs. recombination



Begun and Aquadro (1992)

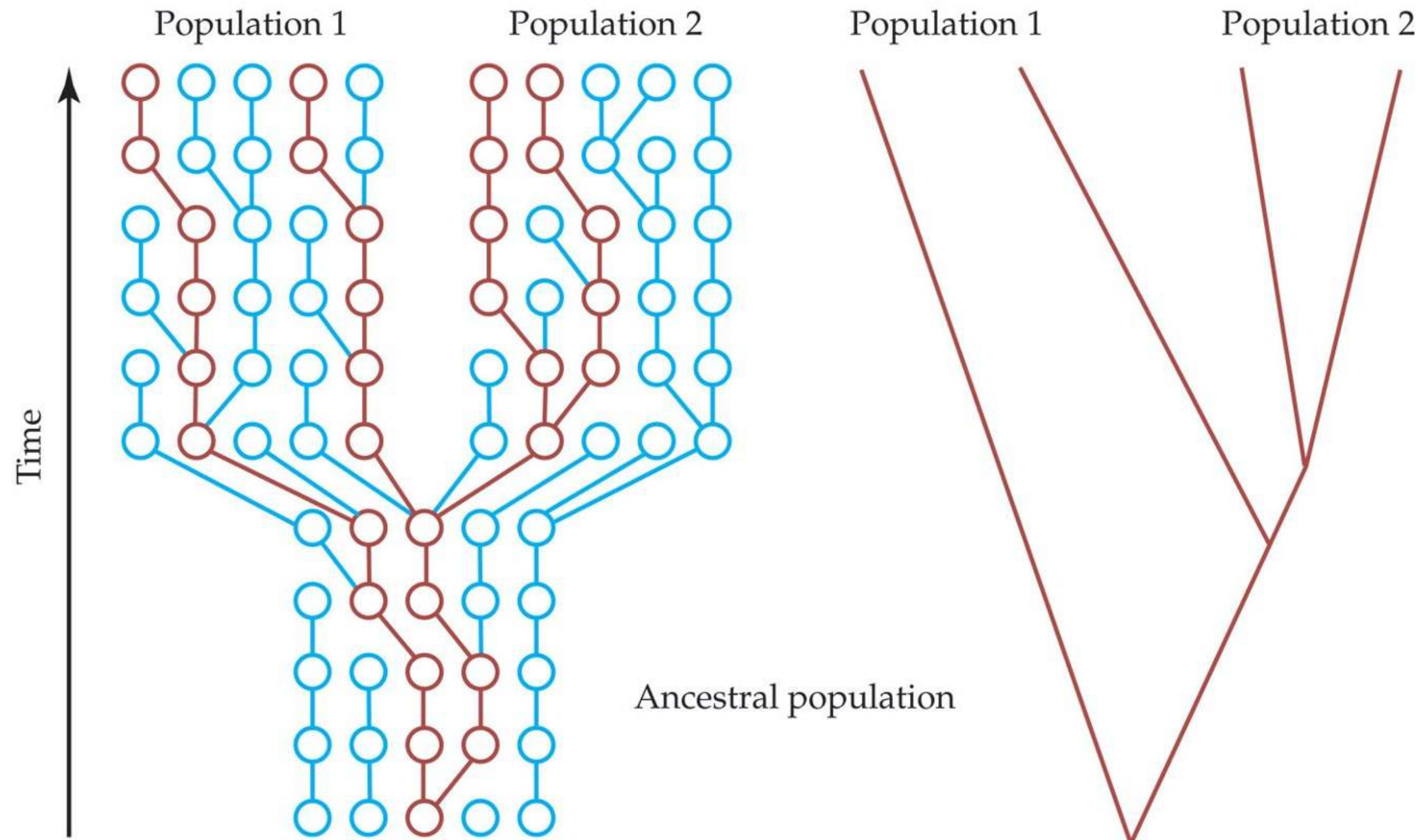
Cumulative distribution function of exponential: $1 - e^{-\lambda x}$

(For coalescent, $\lambda = 1$)



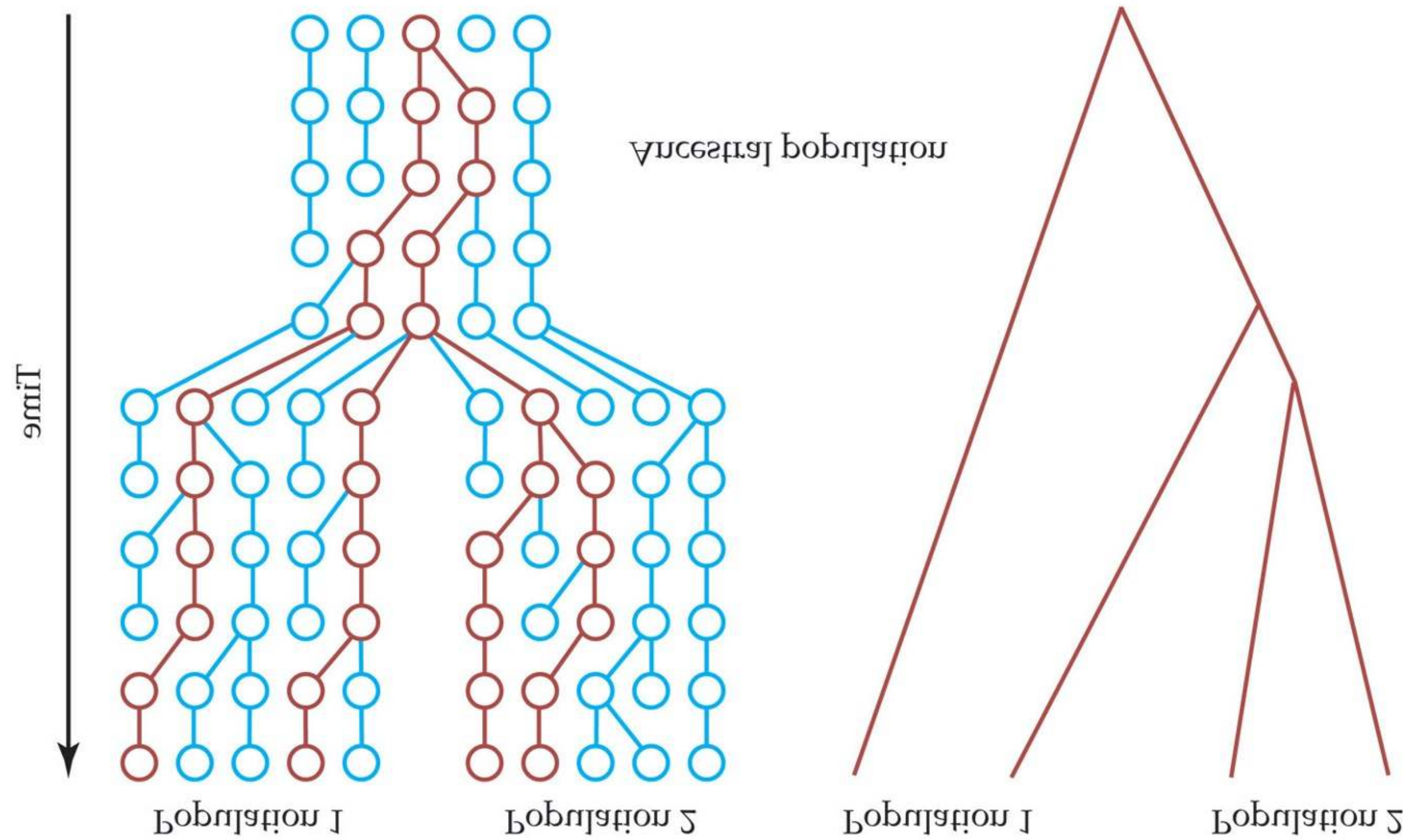
(B)

Incomplete lineage sorting



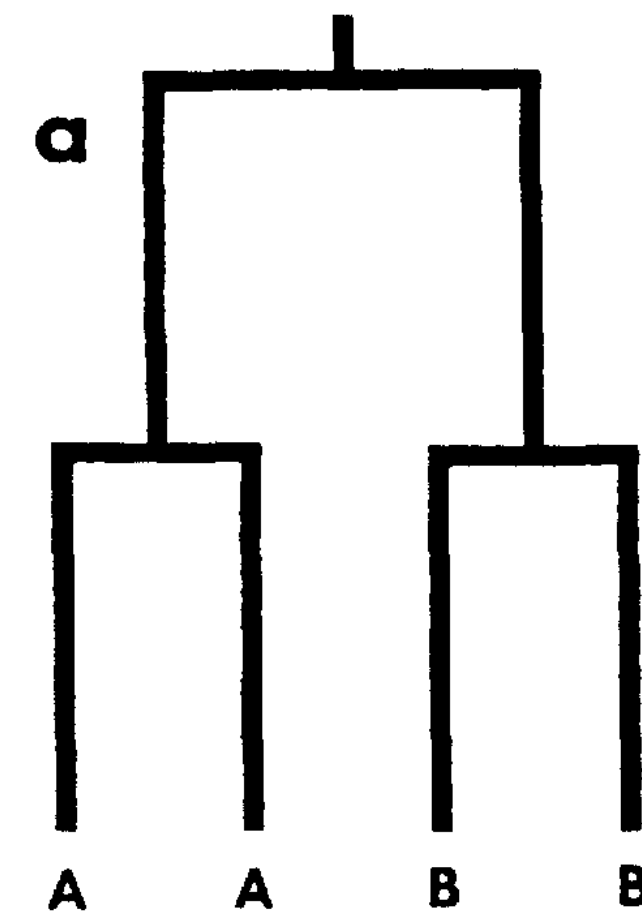
INTRODUCTION TO POPULATION GENETICS, Figure 5.5 (Part 2)
© 2013 Sinauer Associates, Inc.

Nielsen and Slatkin (2013)

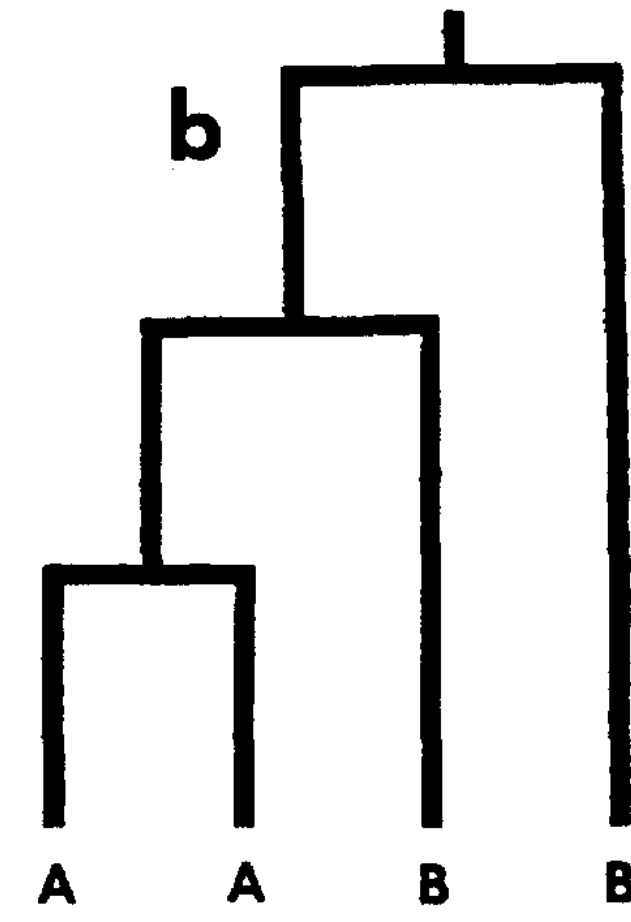


(B)

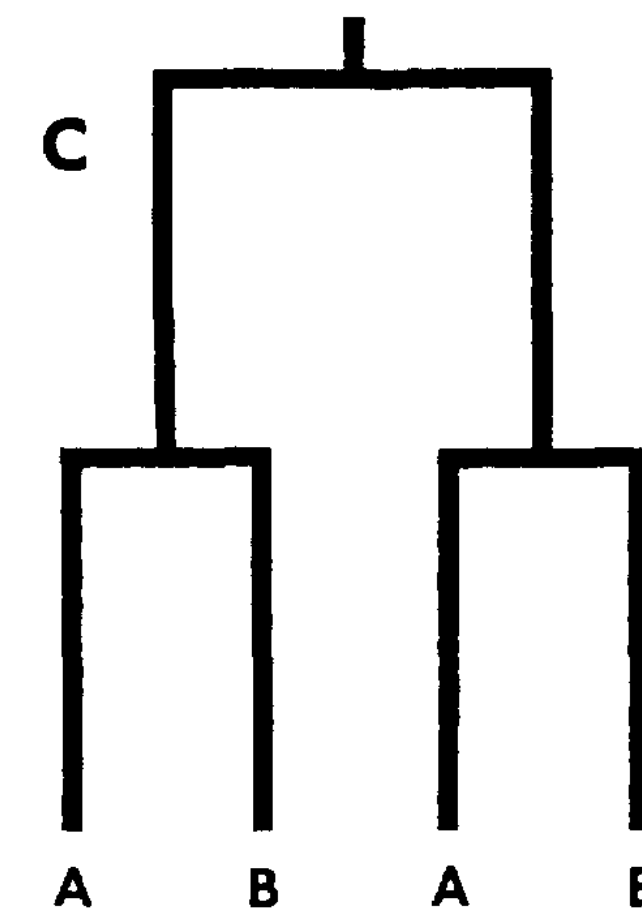
Incomplete lineage sorting



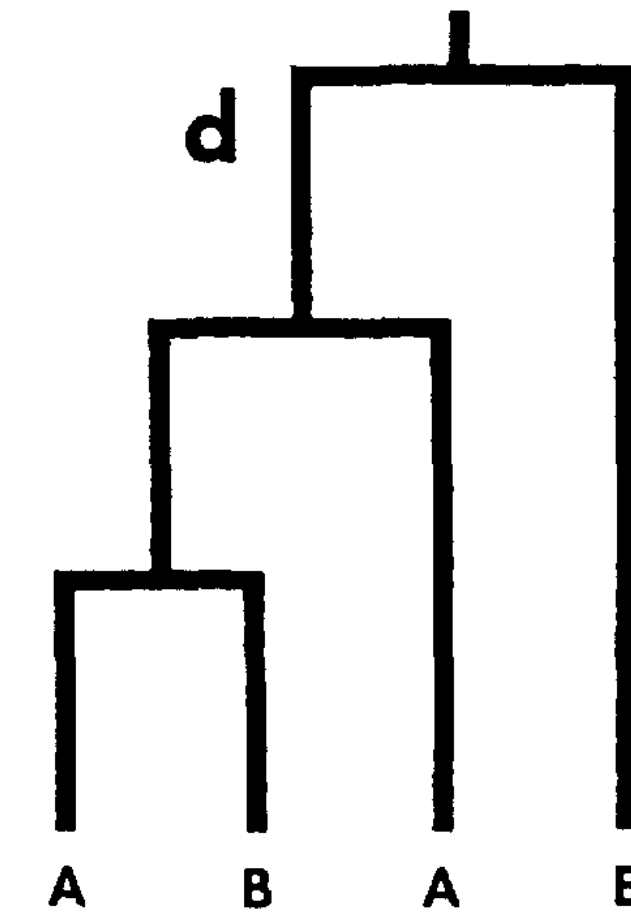
$$P = \left(1 - \frac{2}{3} e^{-\frac{t}{2N}}\right)^2$$



$$P = \frac{4}{3} e^{-\frac{t}{2N}} \left(1 - \frac{5}{6} e^{-\frac{t}{2N}}\right)$$

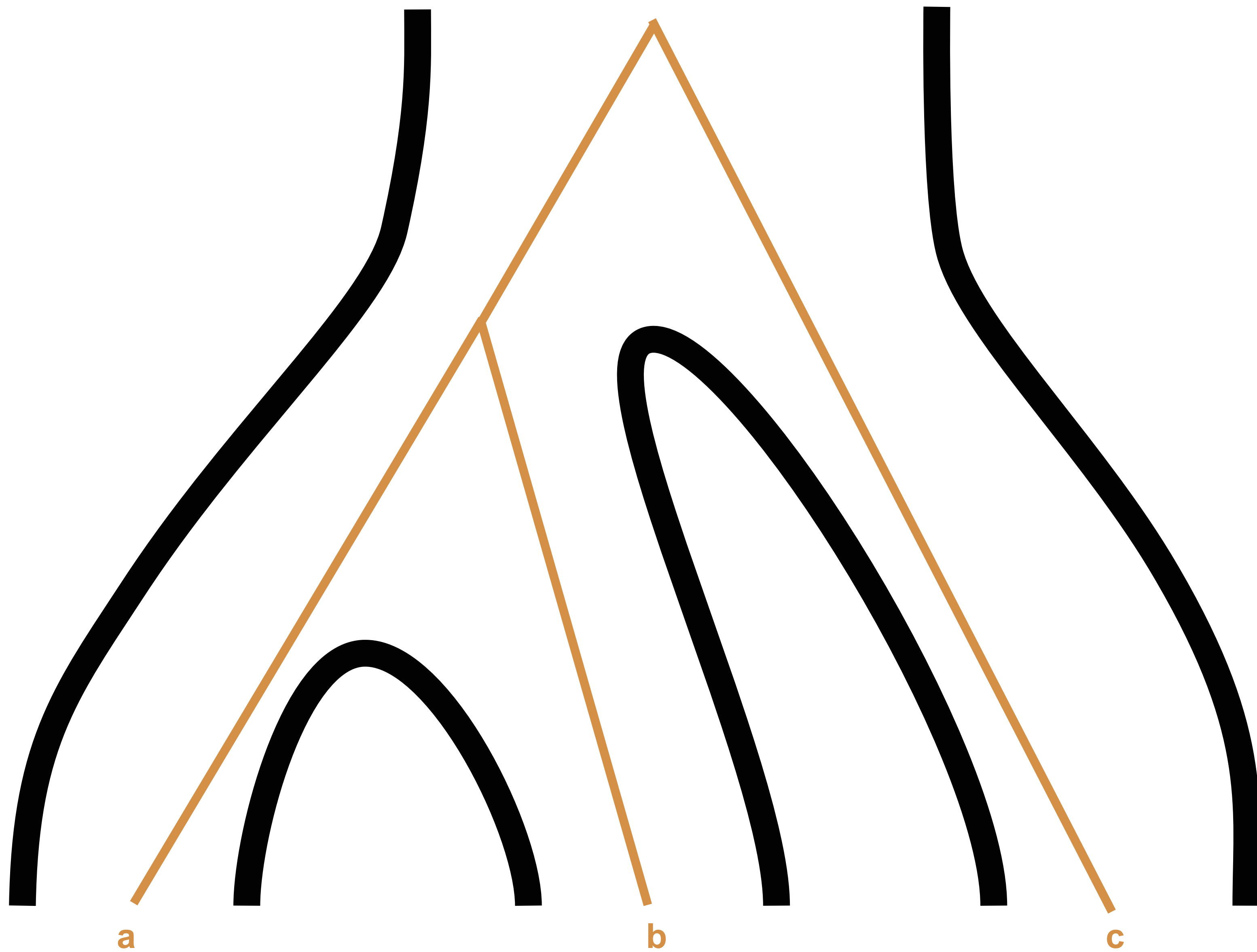


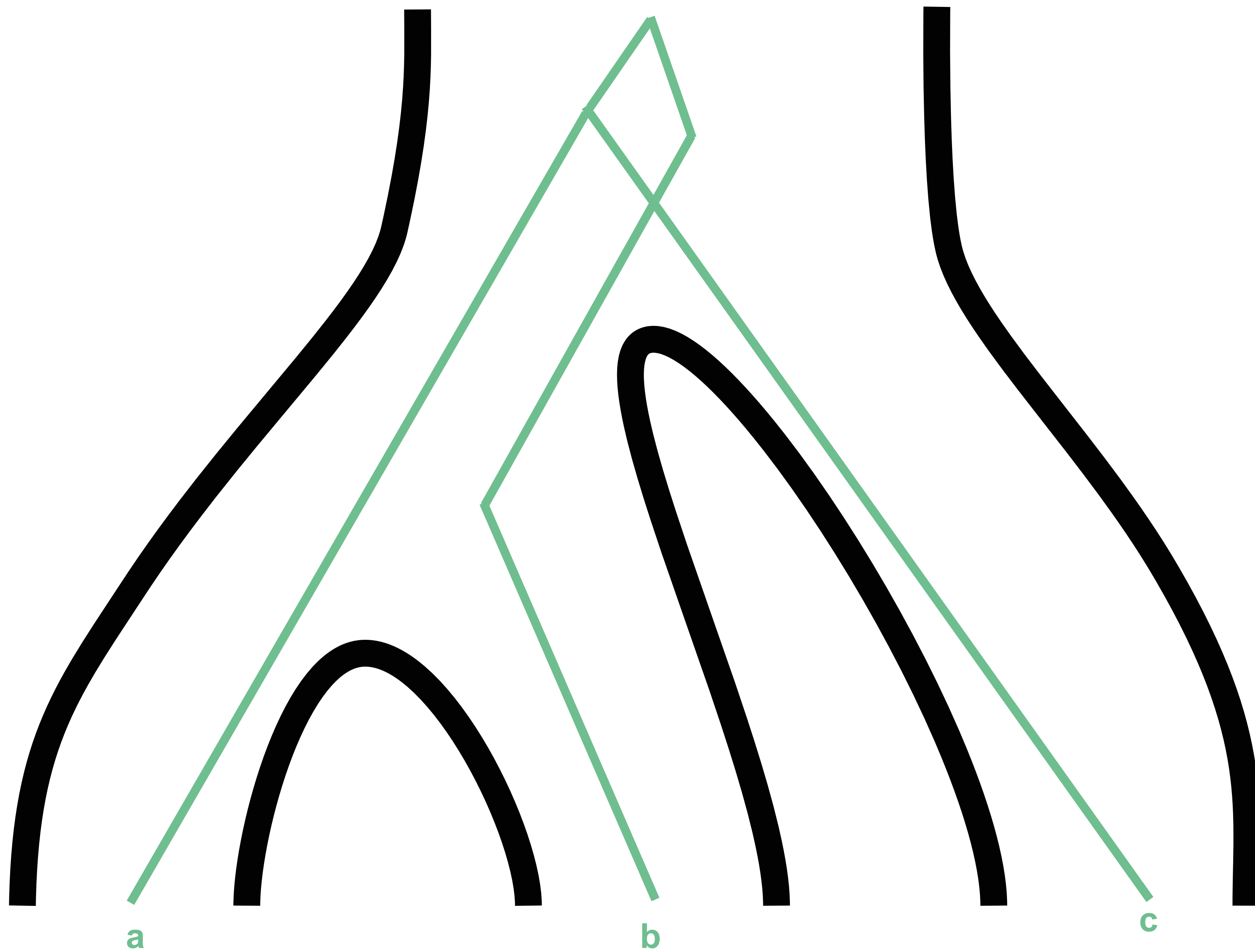
$$P = \frac{2}{9} e^{-\frac{t}{N}}$$

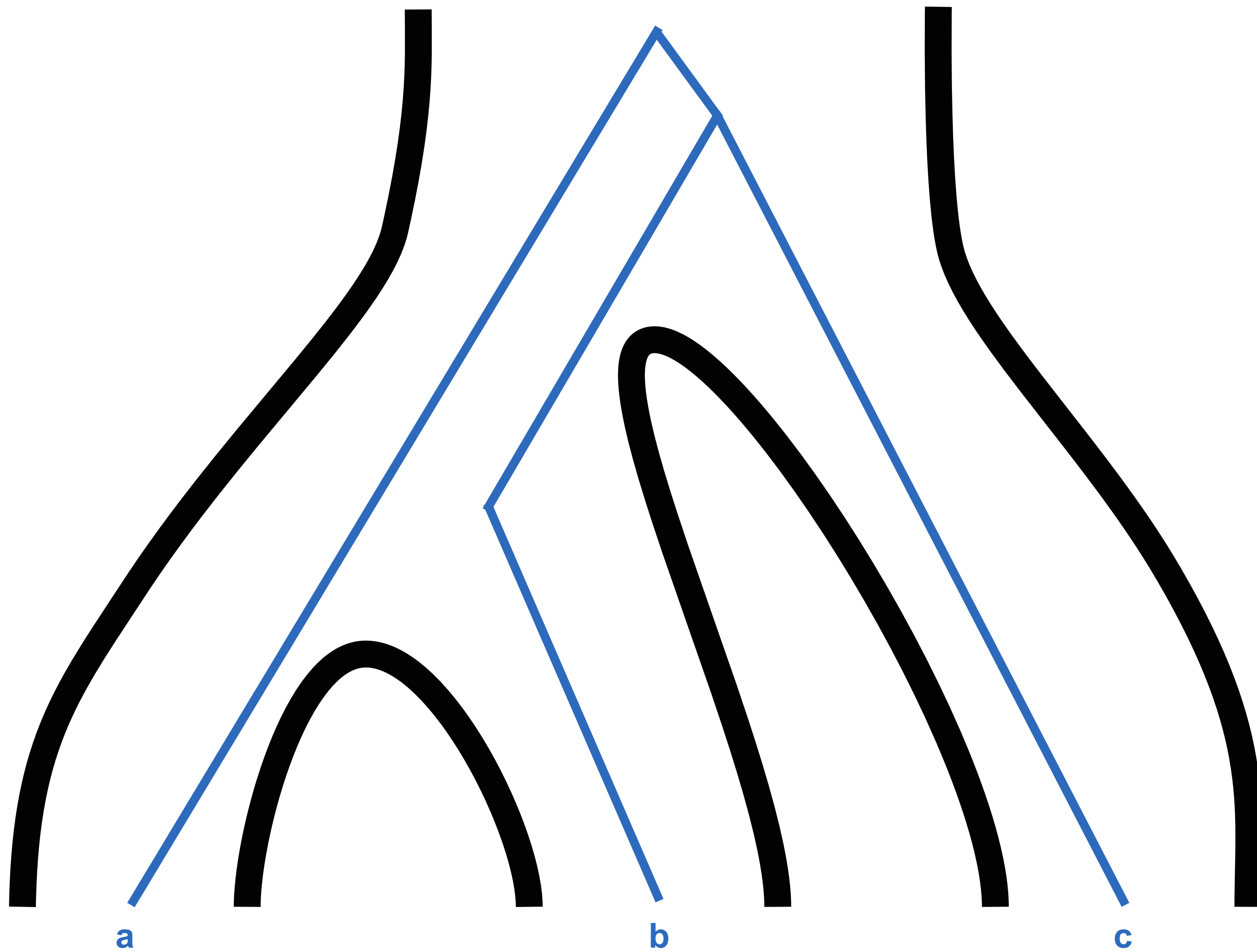


$$P = \frac{4}{9} e^{-\frac{t}{N}}$$

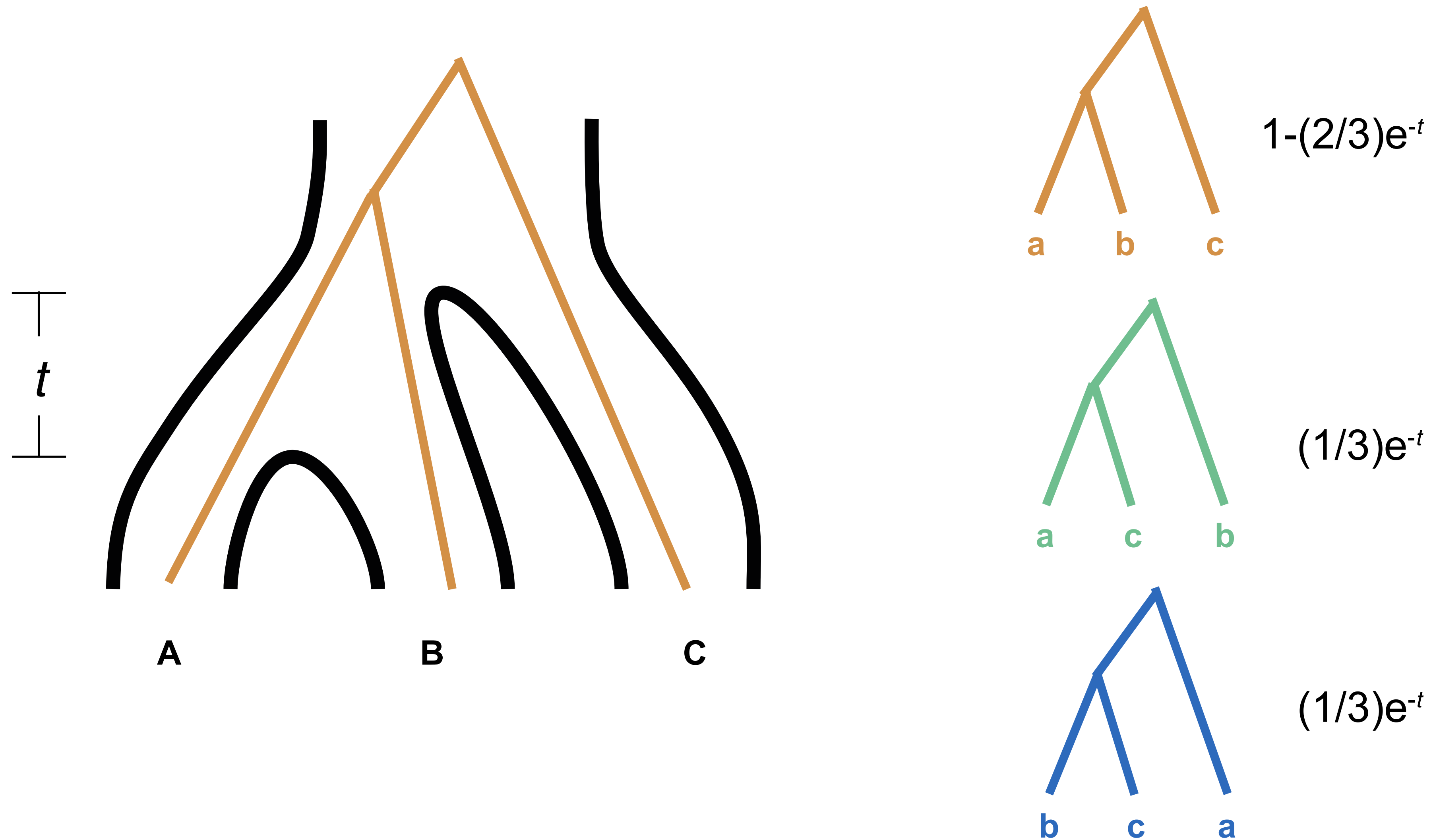
Tajima (1983)

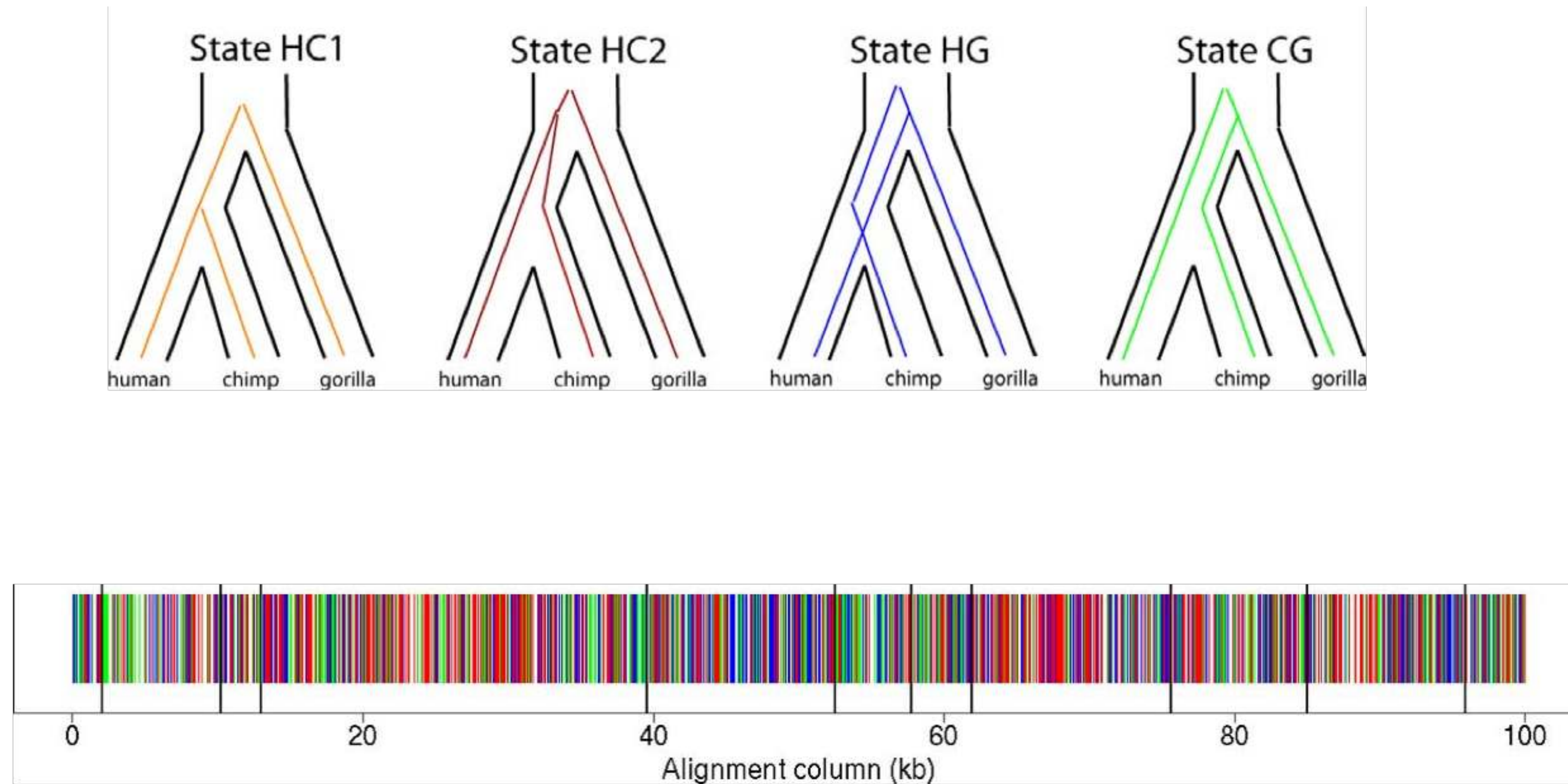




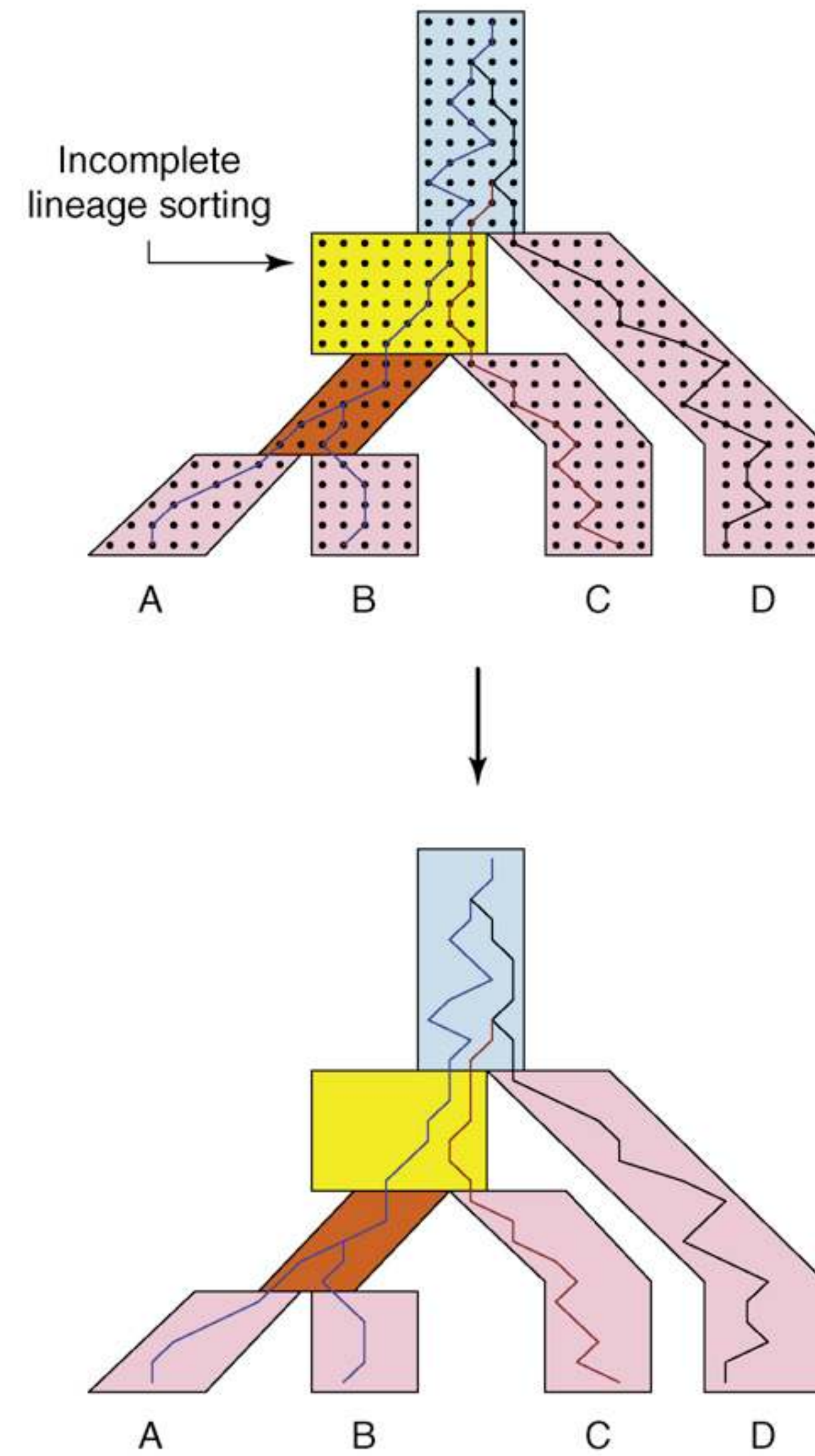


The multispecies coalescent model

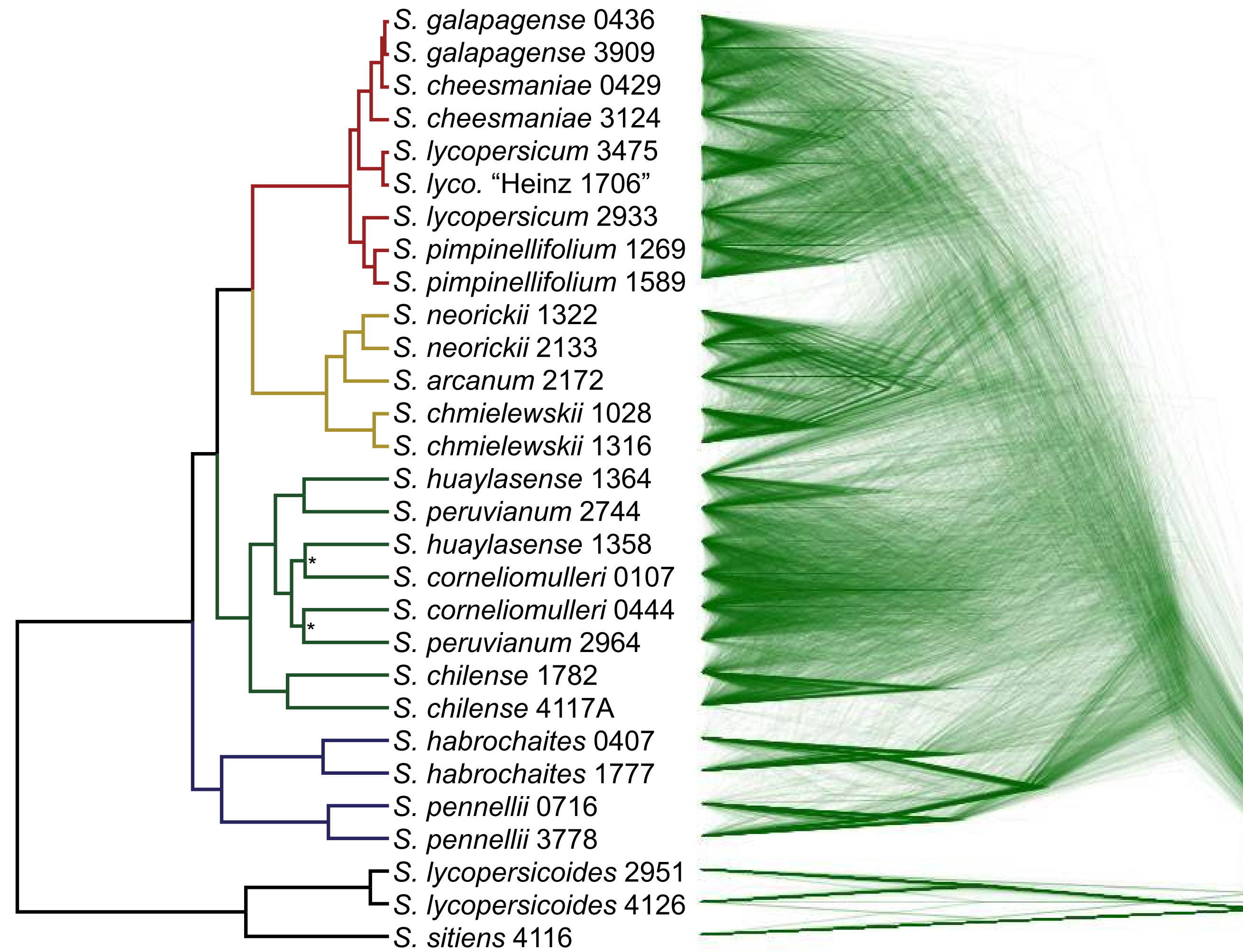




Hobolth et al. (2007)

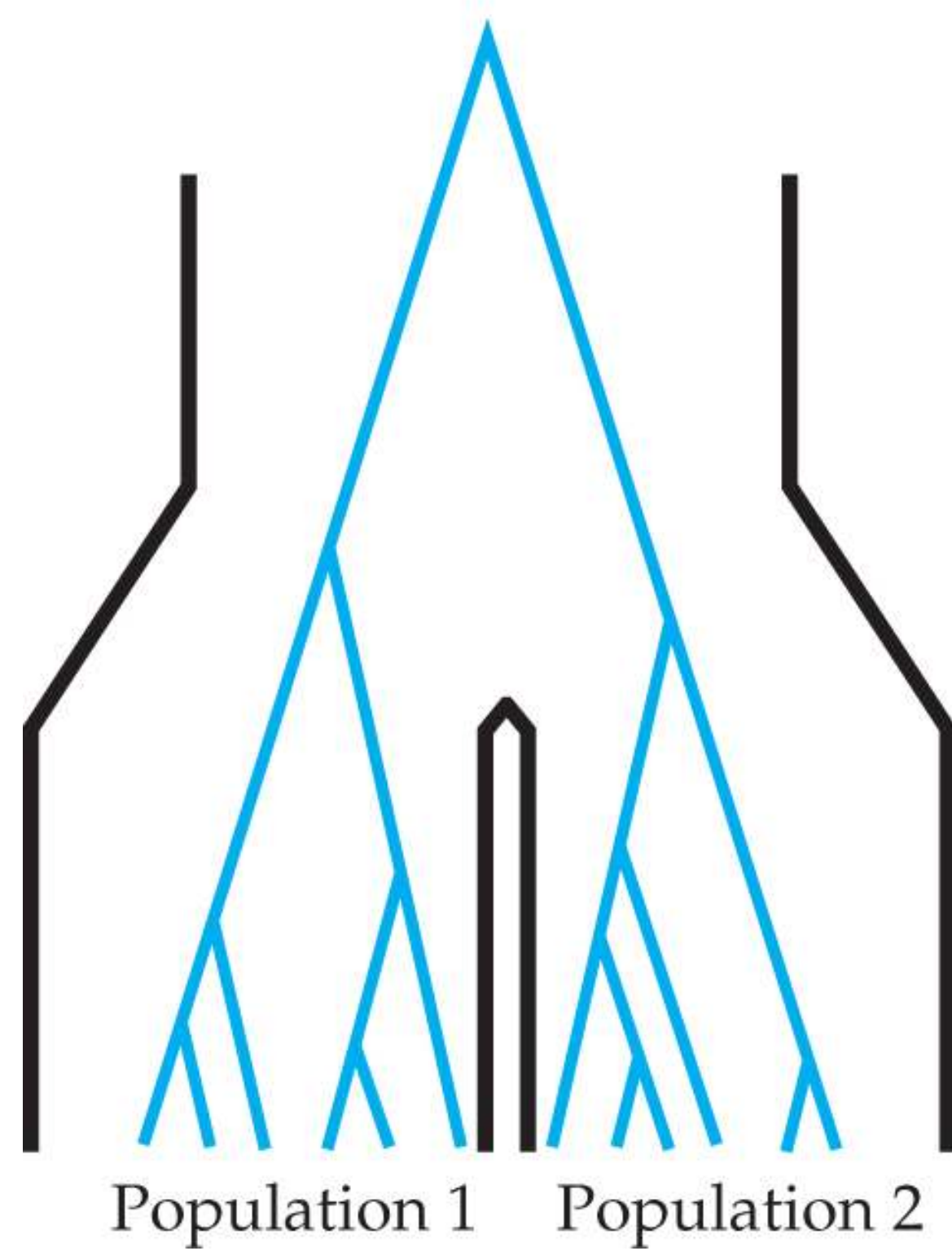


Degnan and Rosenberg (2009)

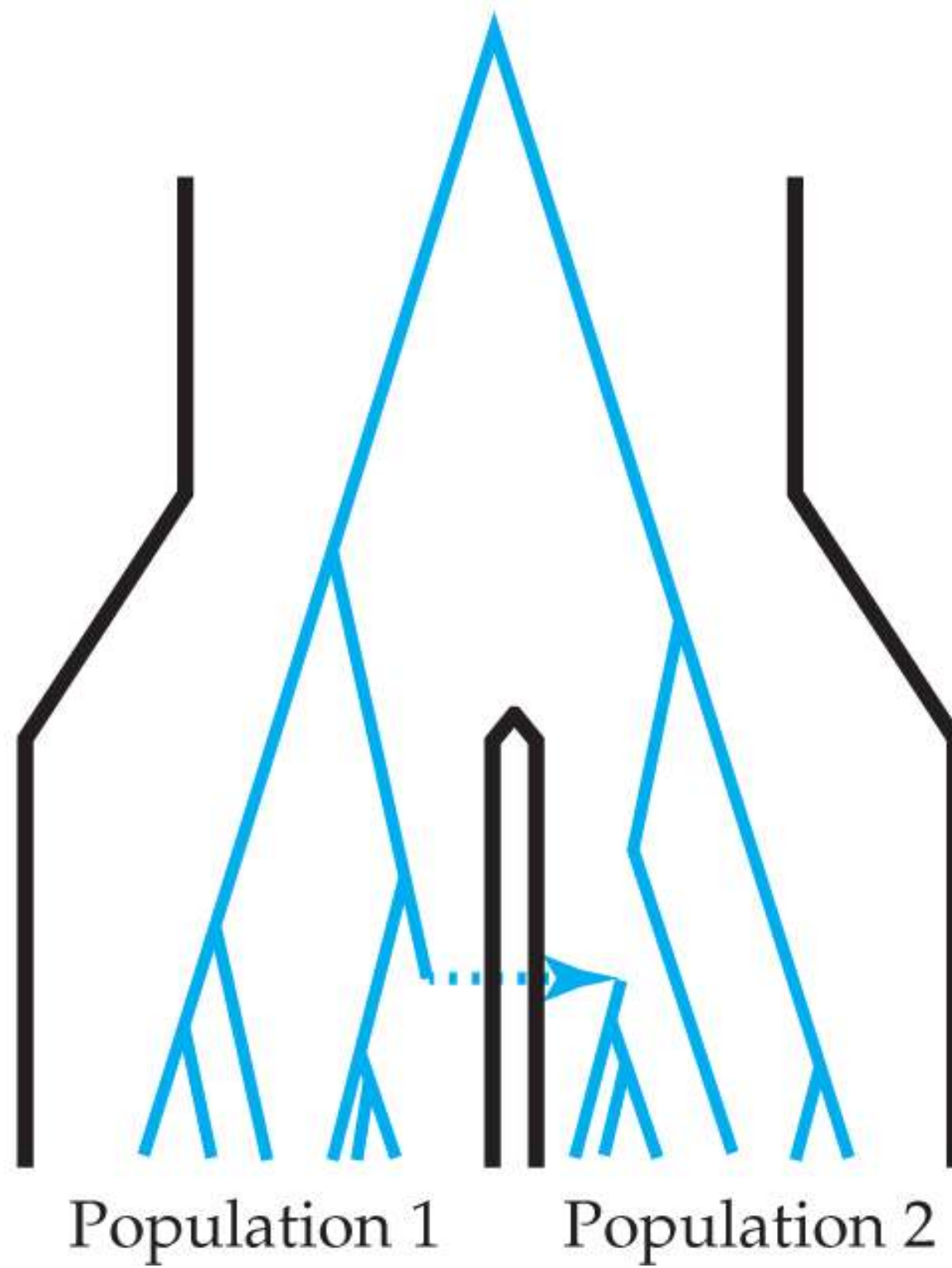


Pease et al. (2016)

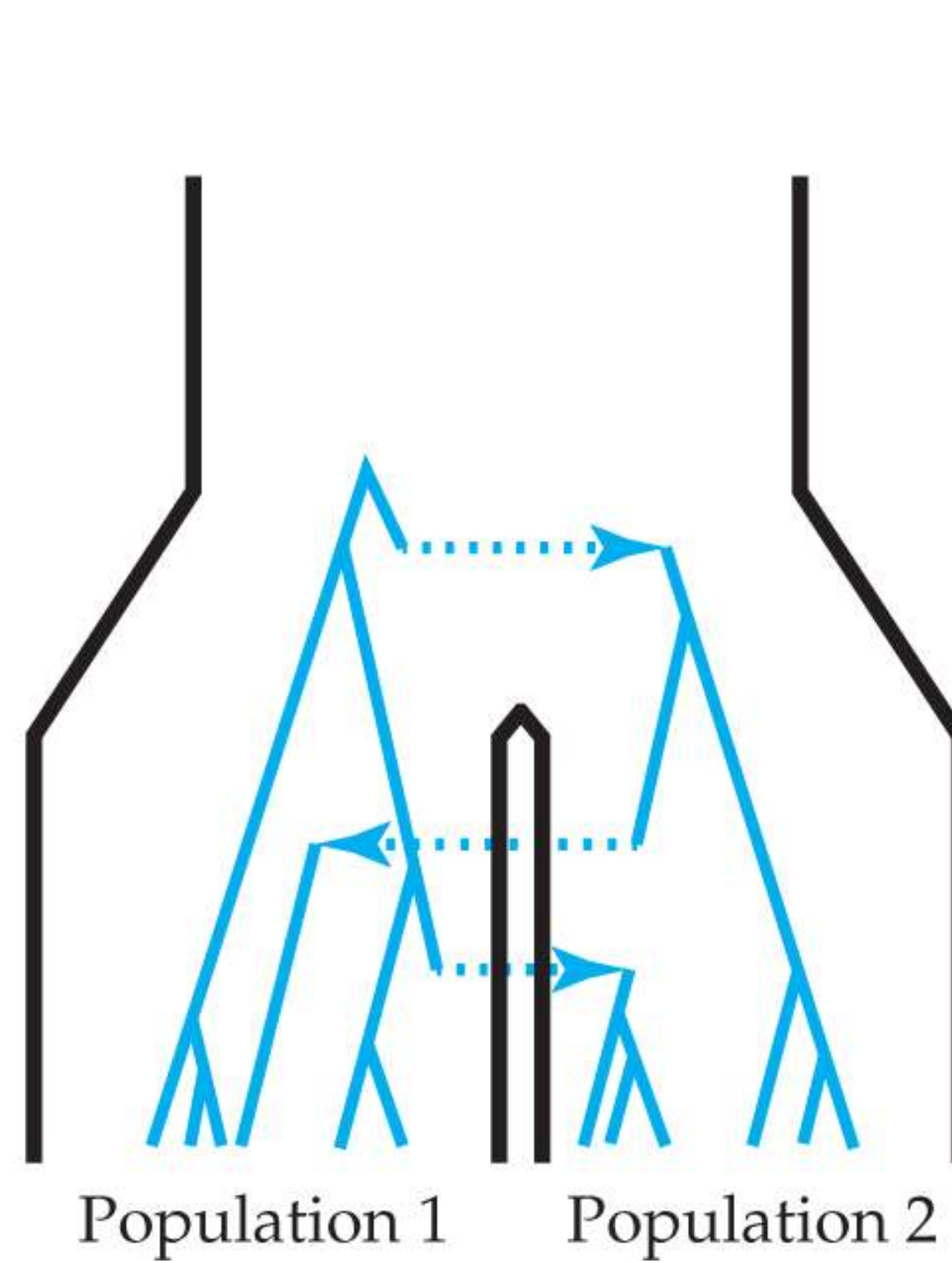
(A)



(B)

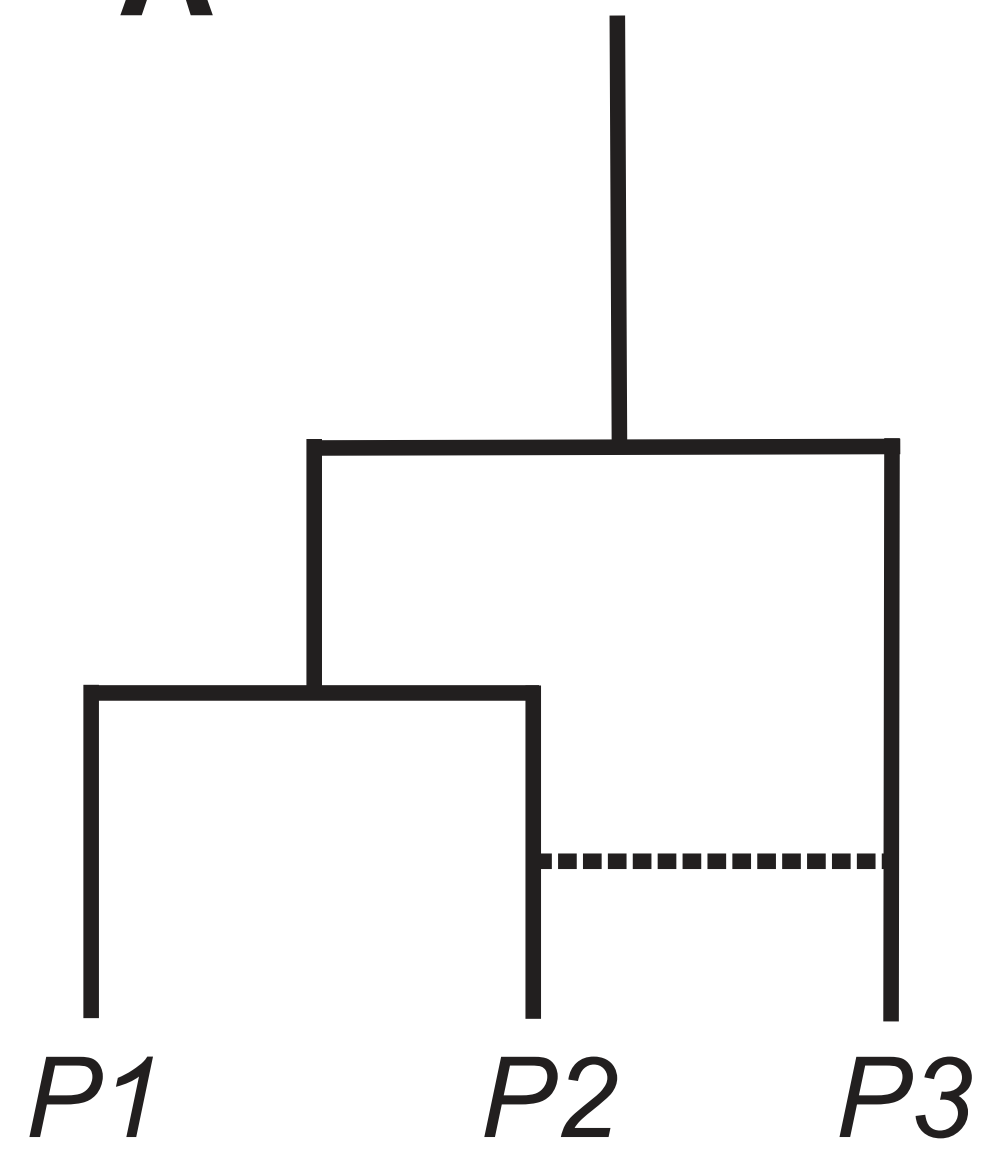


(C)

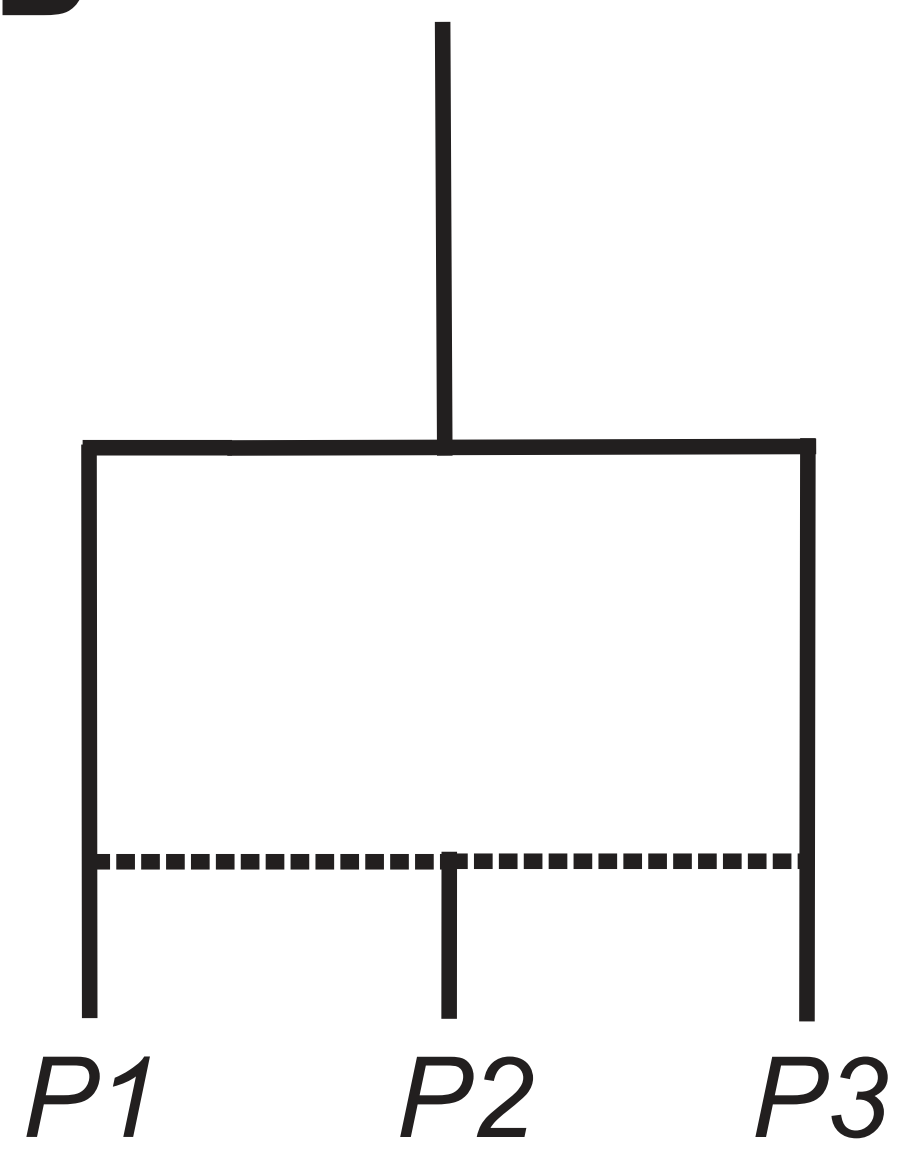


More migration →

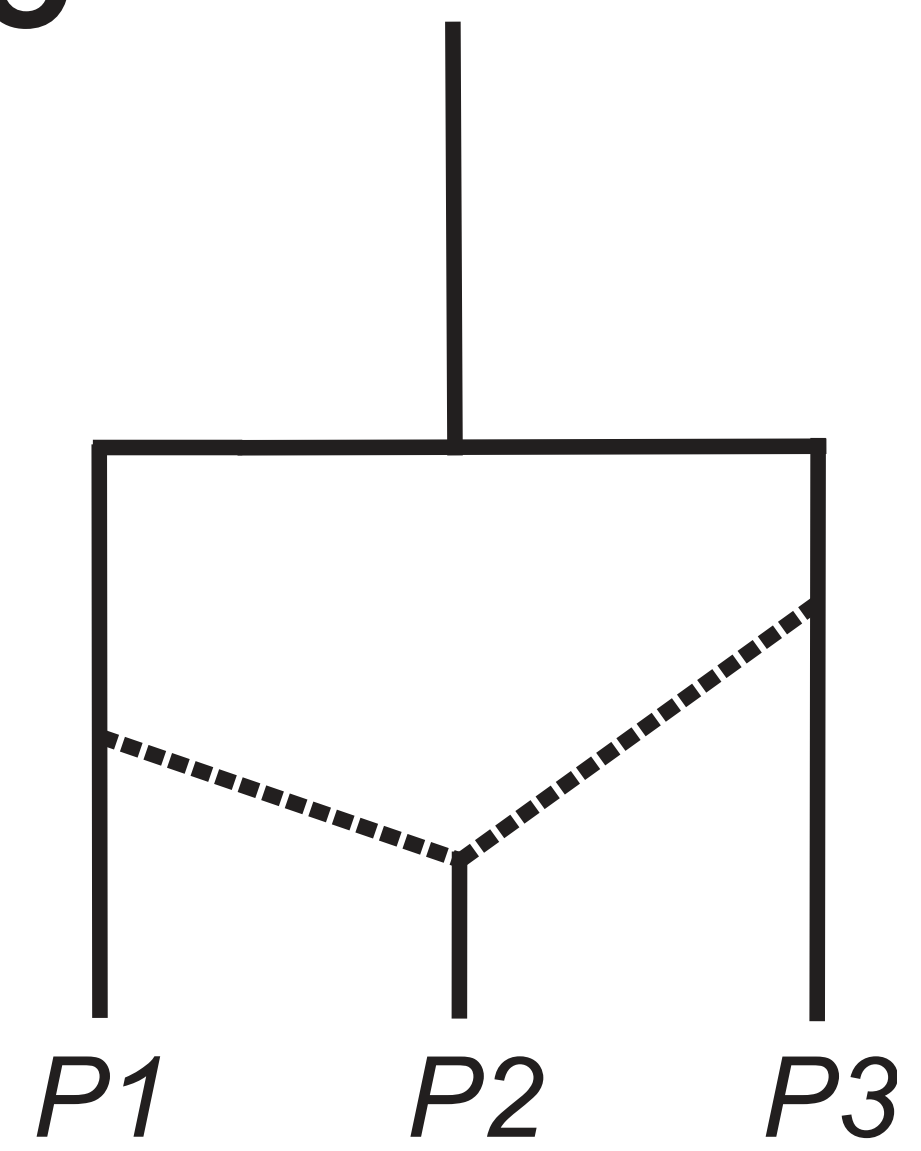
A

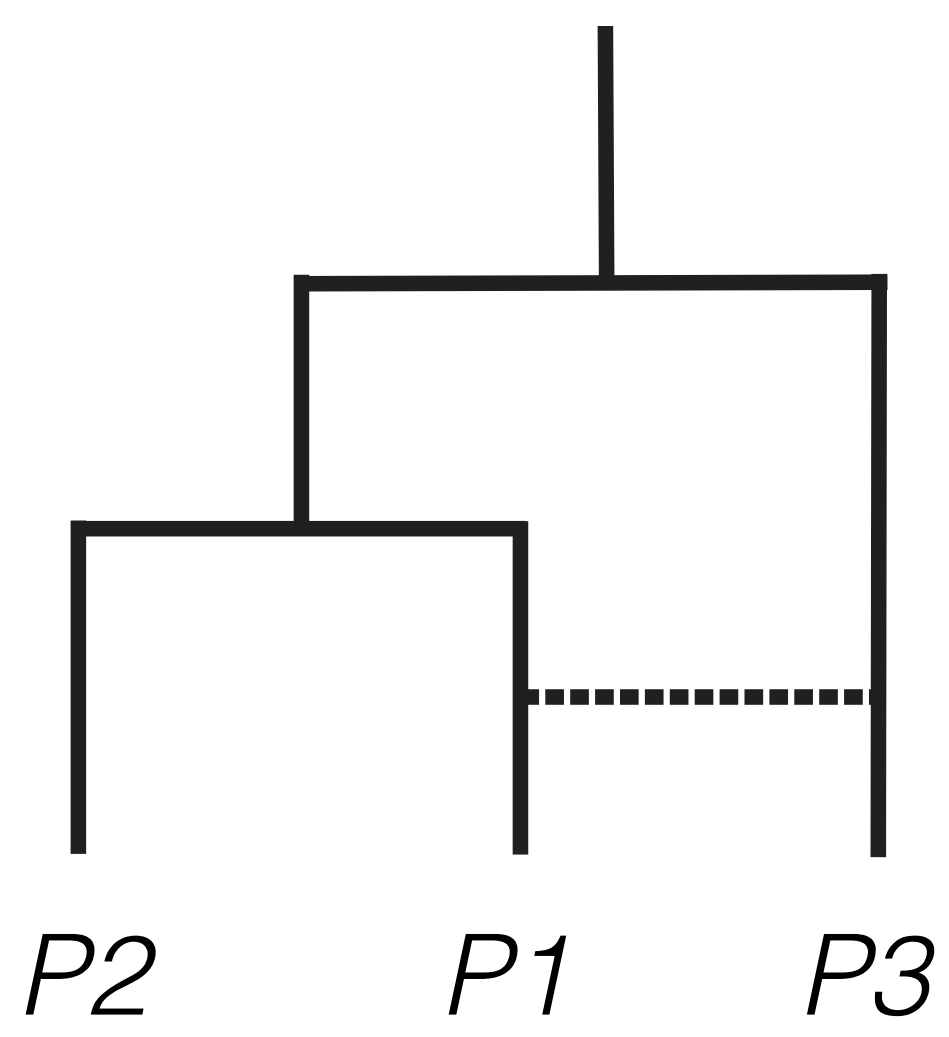


B



C

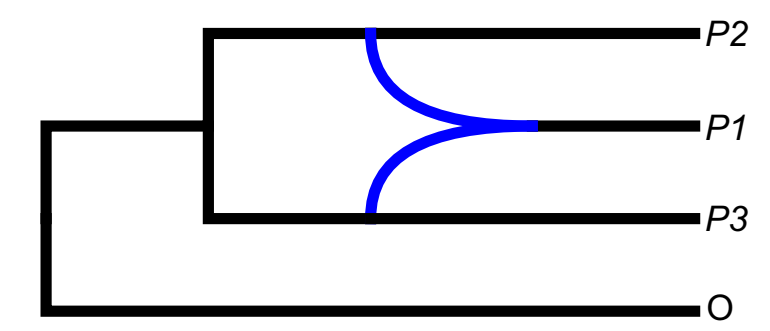




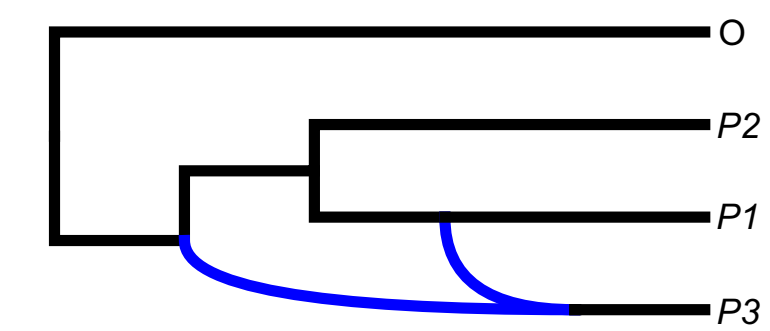
$P3 \rightarrow P1$

$P1 \rightarrow P3$

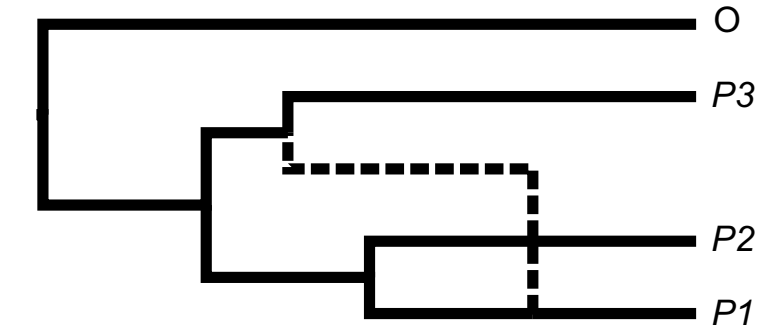
A



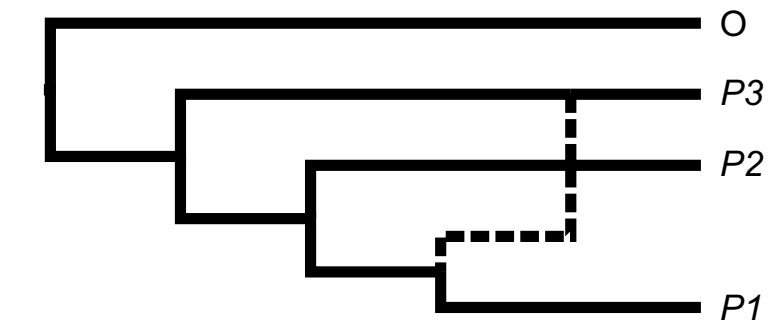
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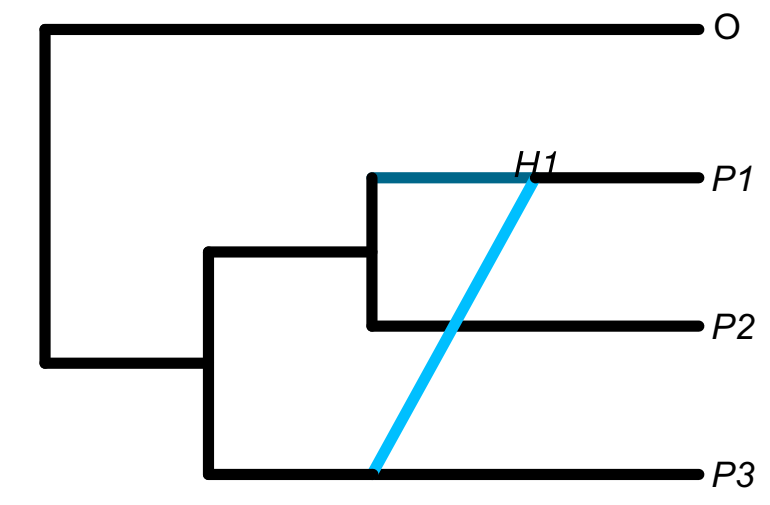
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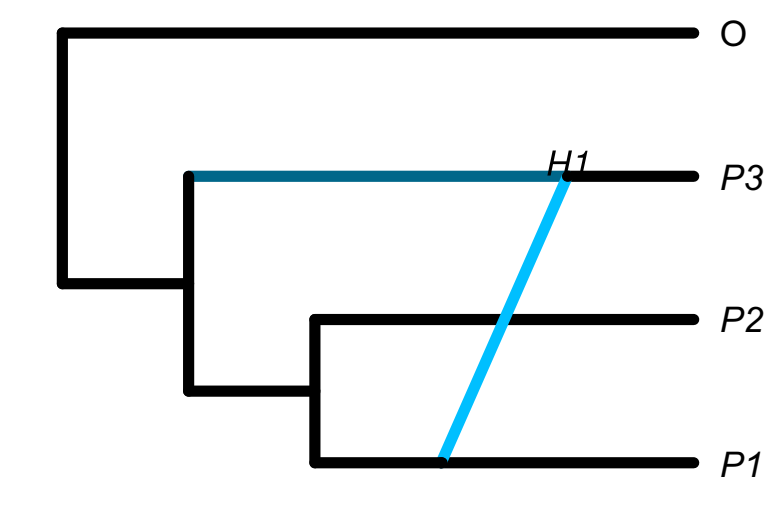
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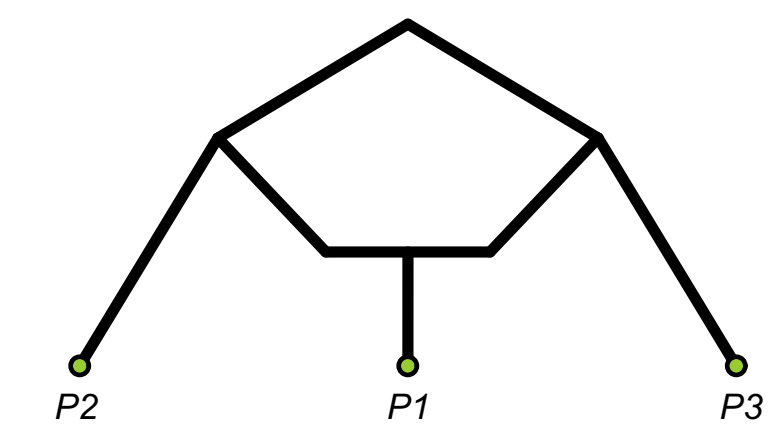
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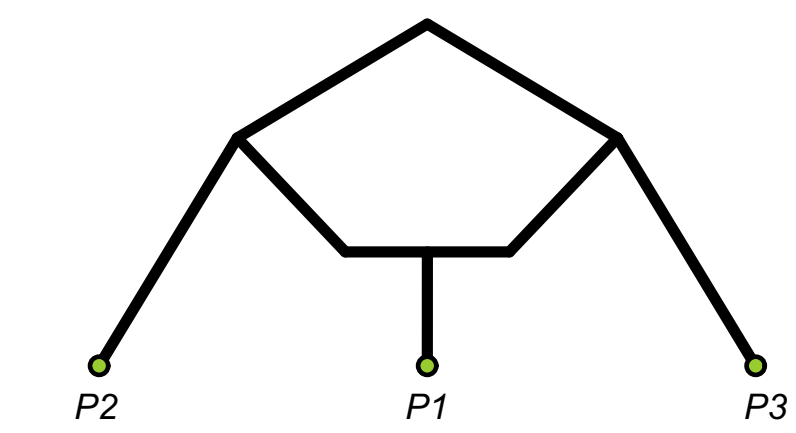
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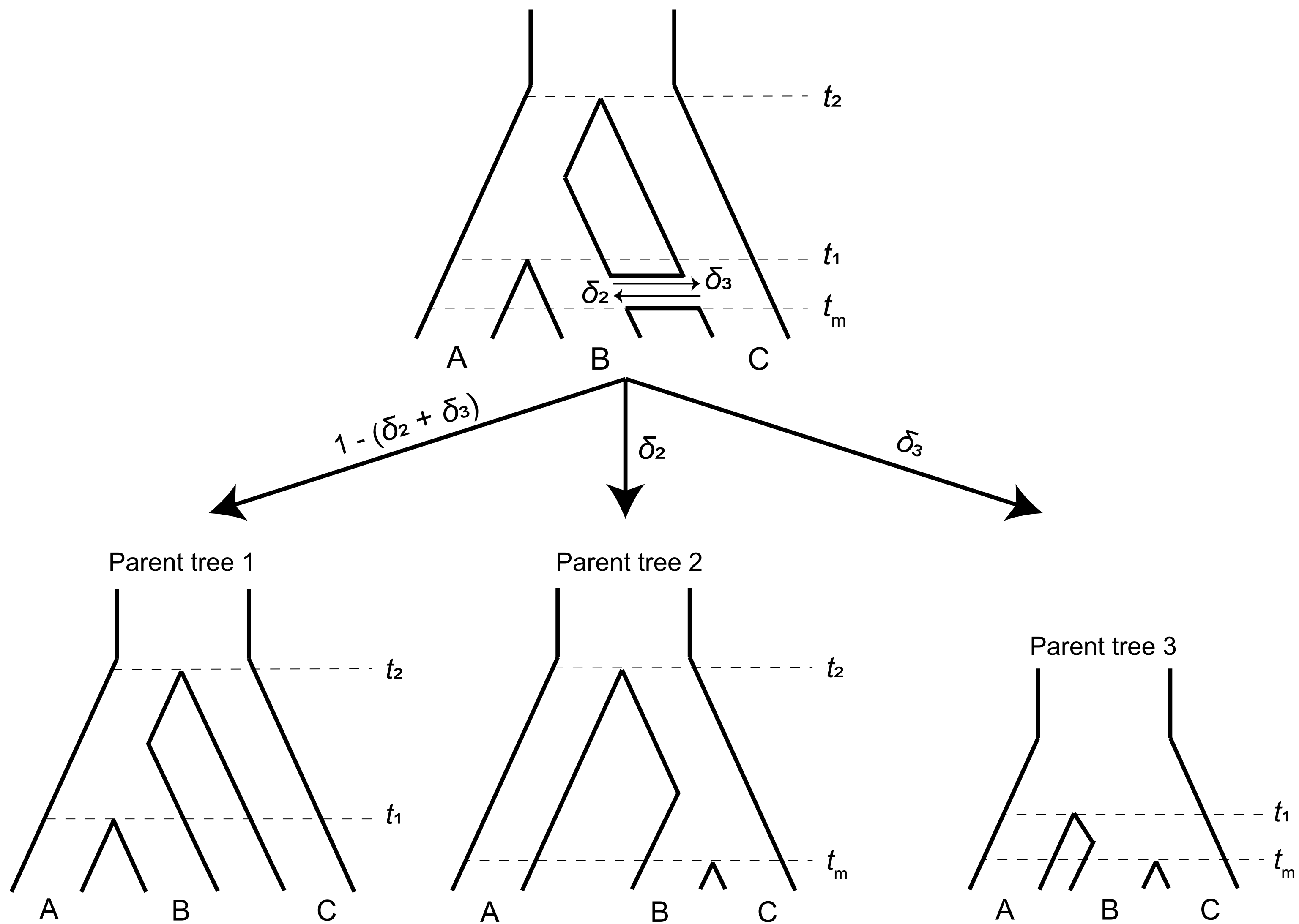


G

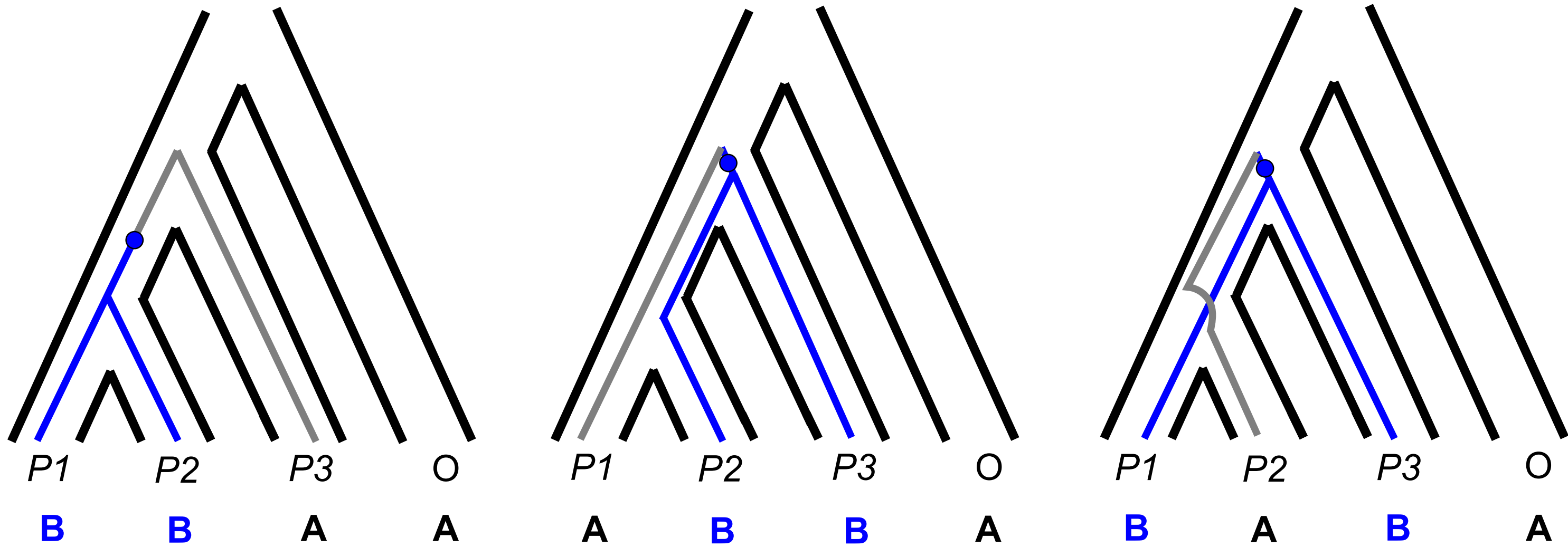


H





ILS only:



ILS + introgression:

