Introduction to computational population genetics

A brief tutorial on *msprime*

Contents

- Brief introduction to coalescent simulation
- Basic usage of *msprime*
- Extensions to standard coalescent

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What is population genetics about?

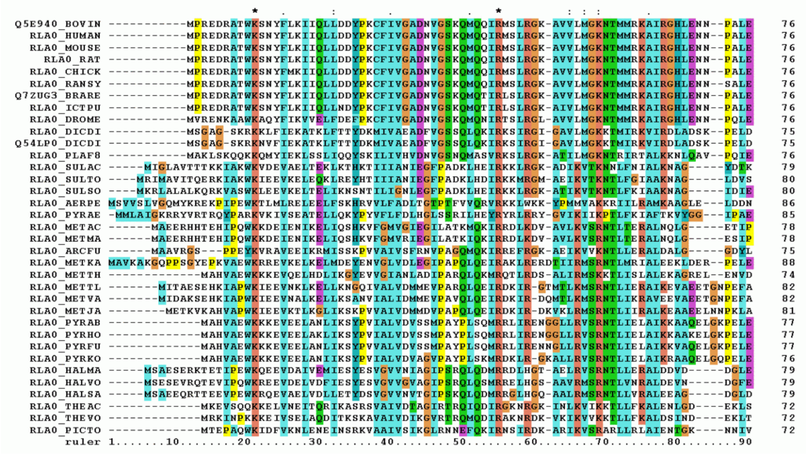
Population genetics

From Wikipedia, the free encyclopedia

Population genetics is a subfield of genetics that deals with genetic differences within and between populations, and is a part of evolutionary biology. Studies in this branch of biology examine such phenomena as adaptation, speciation, and population structure.[1]

https://en.wikipedia.org/wiki/Population_genetics

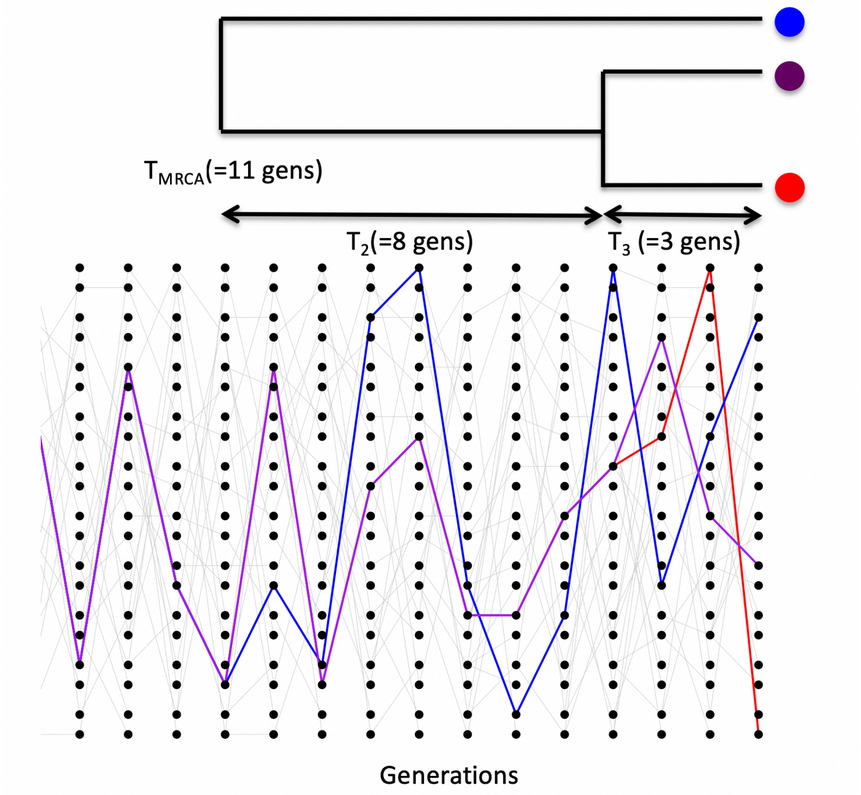
Genetic variation data in population(s) → **Knowledge about population history**

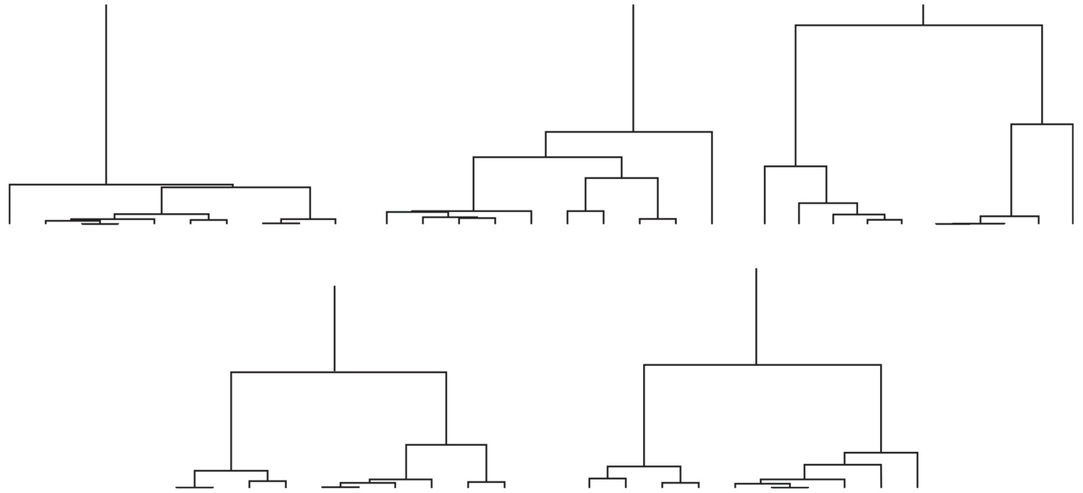


https://en.wikipedia.org/wiki/Multiple_sequence_alignment

Population size change, natural selection, migration, population divergence, admixture, etc.

A brief introduction to coalescent theory



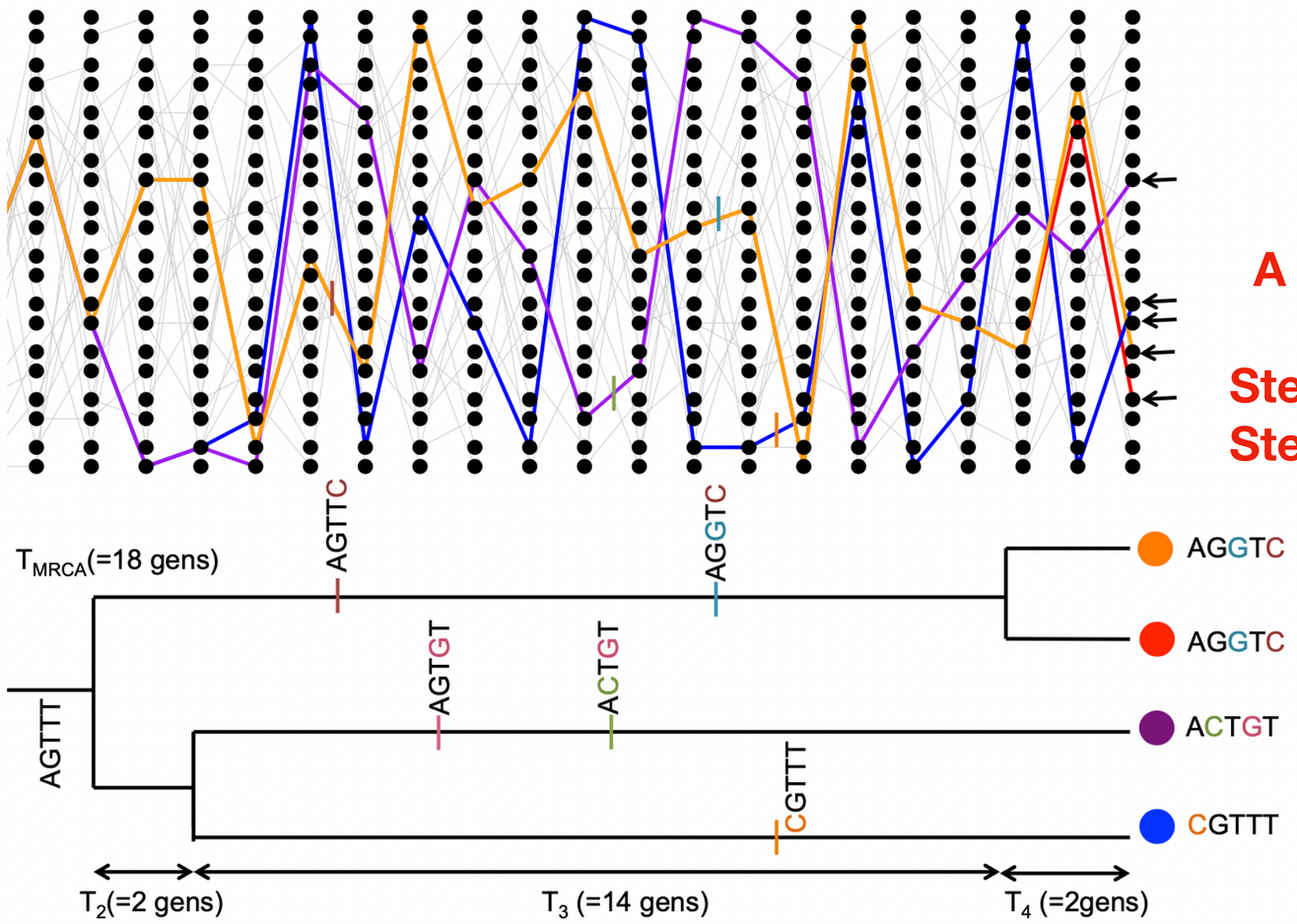


Hein et al, 2004

$$T_i \sim \text{Geo}\left(\binom{i}{2}/2N\right)$$

Notes from Graham Coop

Single locus coalescent

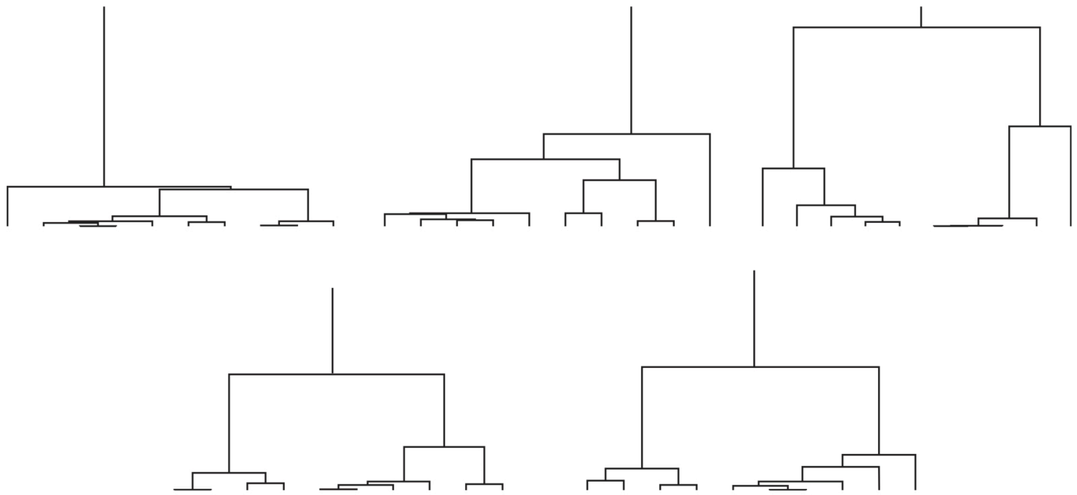


A generative model for genetic variation data!

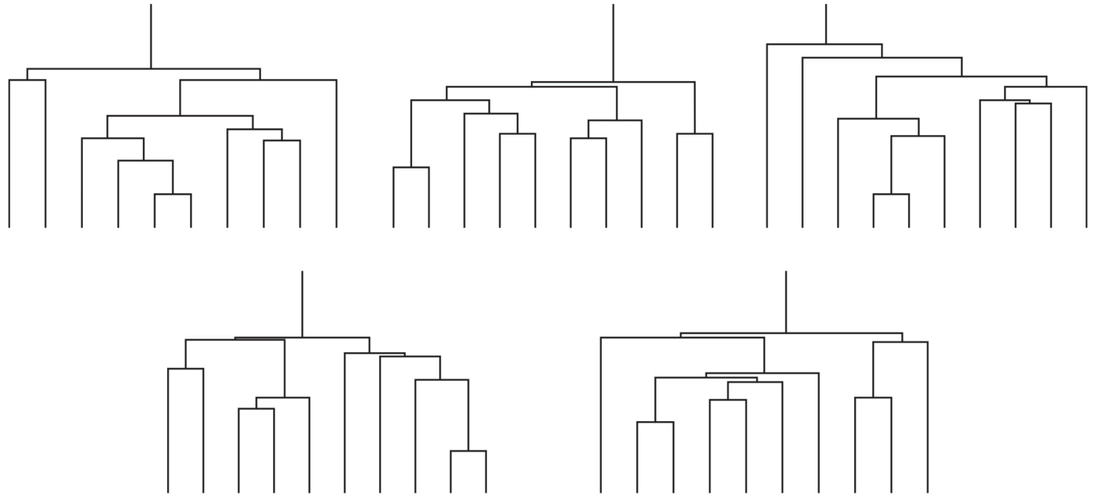
Step 1: generate the underlying genealogy
Step 2: generate mutations given the genealogy

Notes from Graham Coop

Reading history from genealogy/mutation



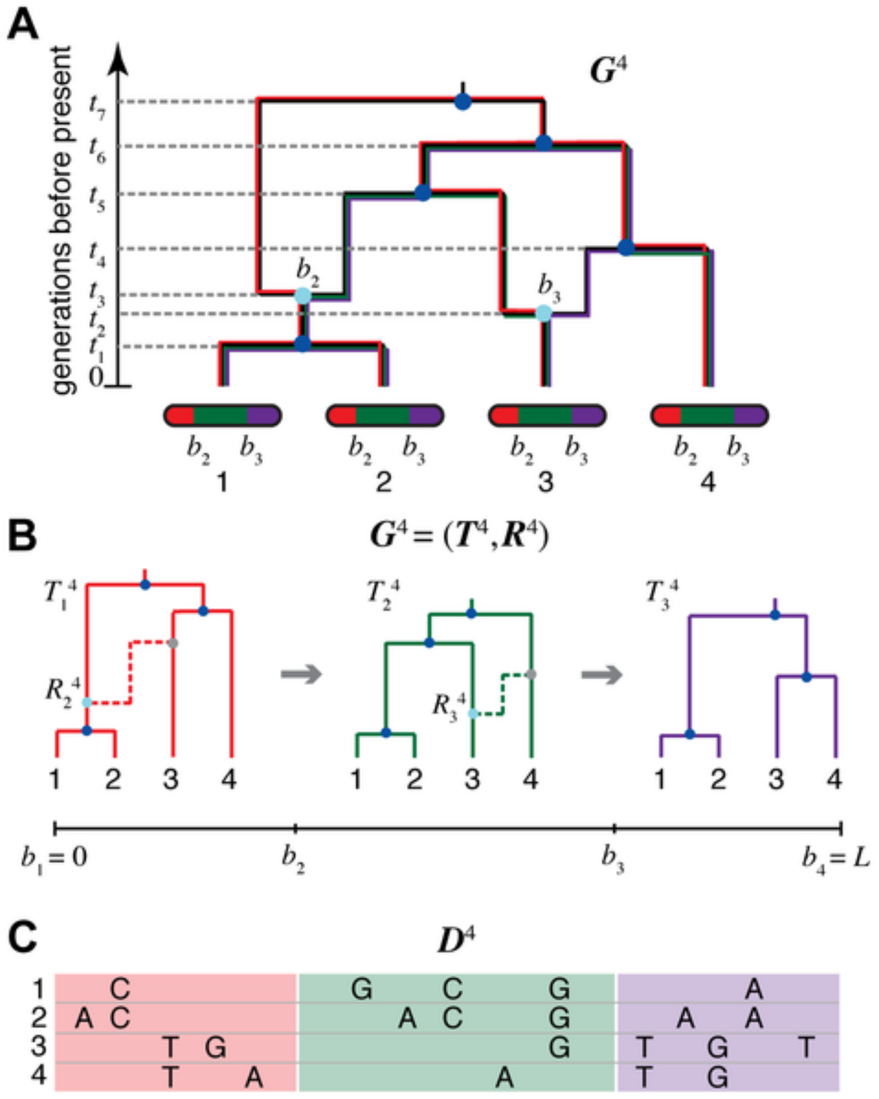
Constant size: fewer singleton mutations



Exponential growth: more singleton mutations

Hein et al, 2004

Coalescent with recombination



Rasmussen et al, 2014

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msprime documentation

Check the full tutorial at this link: https://tskit.dev/msprime/docs/stable/intro.html

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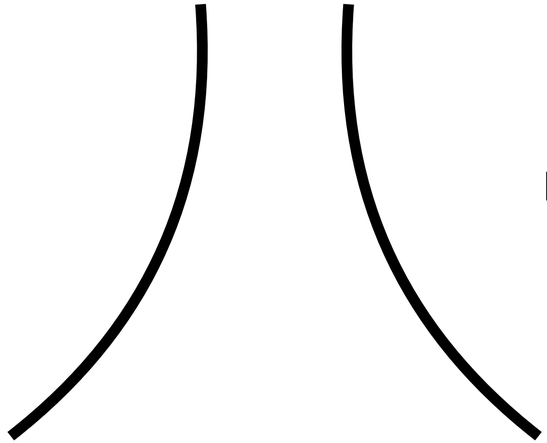
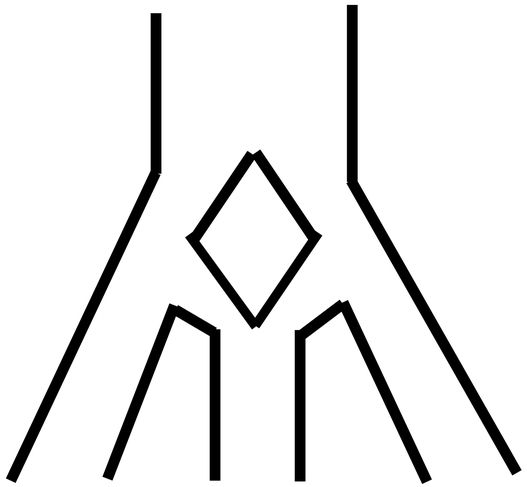
Demography models

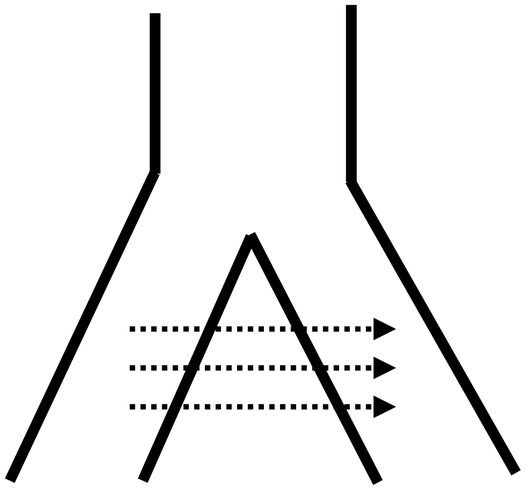
Population split



Exponential growth



Admixture



Migration