Coalescent theory

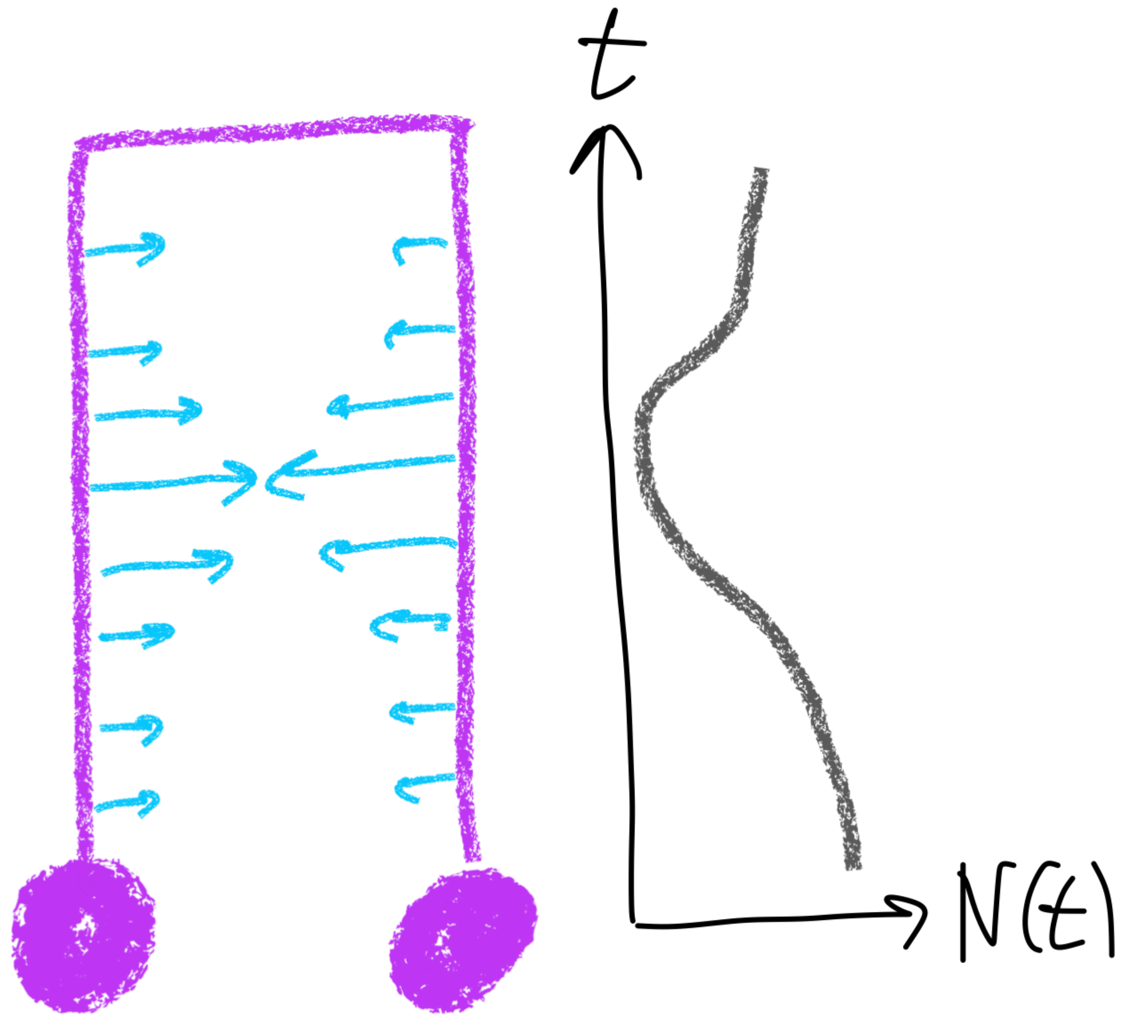
Population size determines coalescence rate

What if population size varies over time? N(t)

[Like students adding/dropping mid-quarter in Cole-escent theory]

N(t) distorts time scale from the standard coalescent

- time compressed when N(t) is small
- time stretched when N(t) is large



The details:

$$\mathbb{P}(T_i = t_i) = \frac{\binom{i}{2}}{2N_{t_i}} \prod_{j=1}^{t_i-1}\left(1-\frac{\binom{i}{2}}{2N_j}\right)$$

$$\xrightarrow{\text{big } N} \quad p(t_i) = \frac{\binom{i}{2}}{2N(t)}\, e^{-\binom{i}{2}\int_0^t \frac{ds}{2N(s)}}$$

inhomogeneous Poisson process

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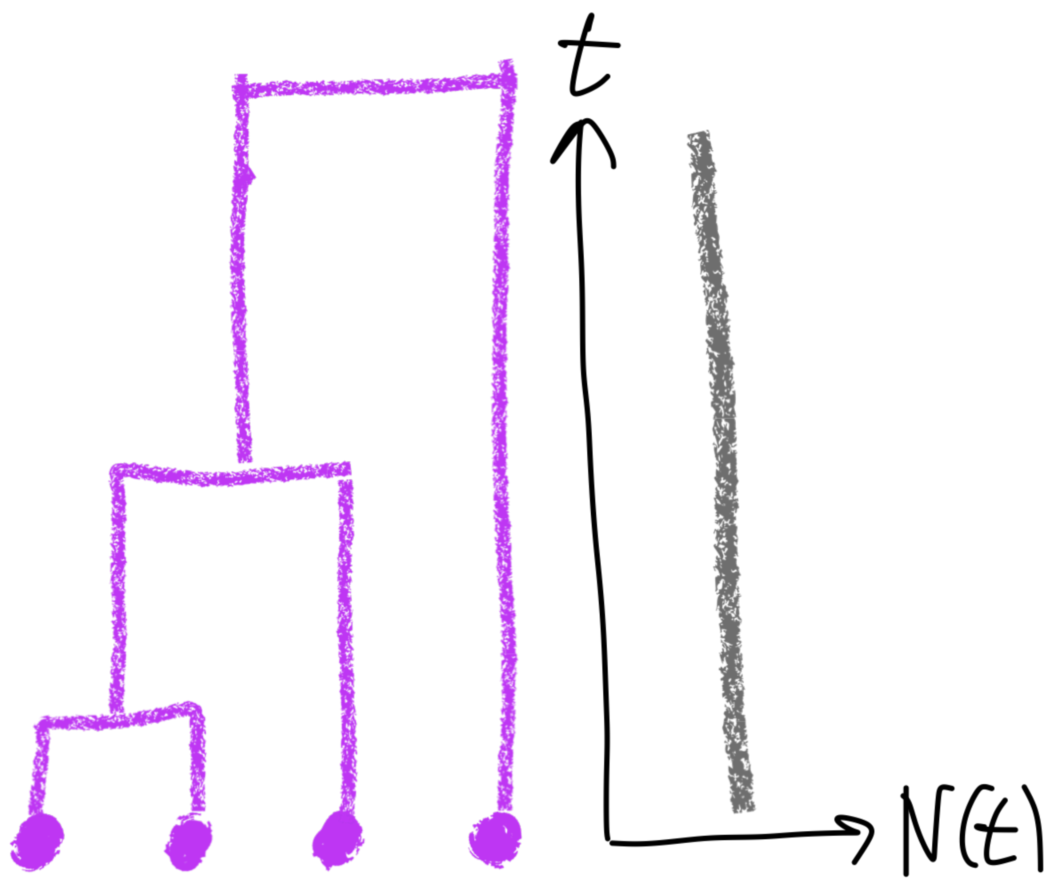
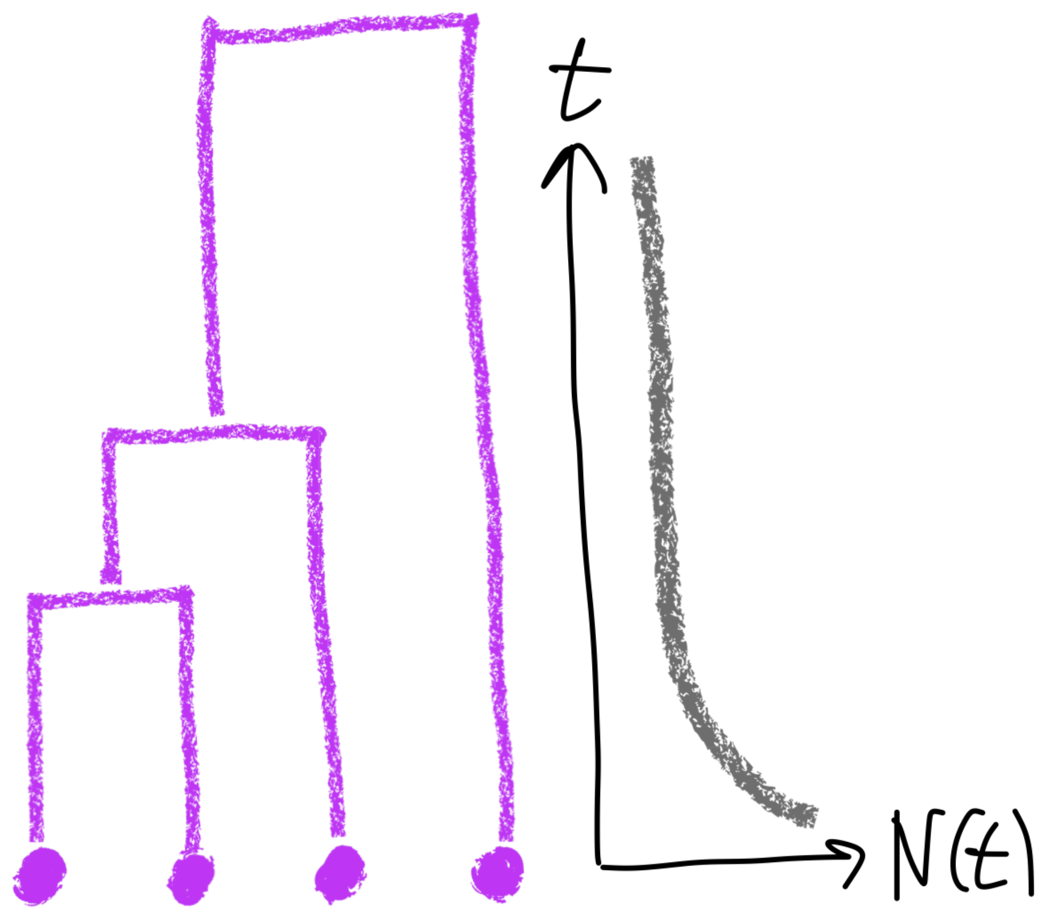
Constant



Exponential growth



Bottleneck