

Coalescent theory

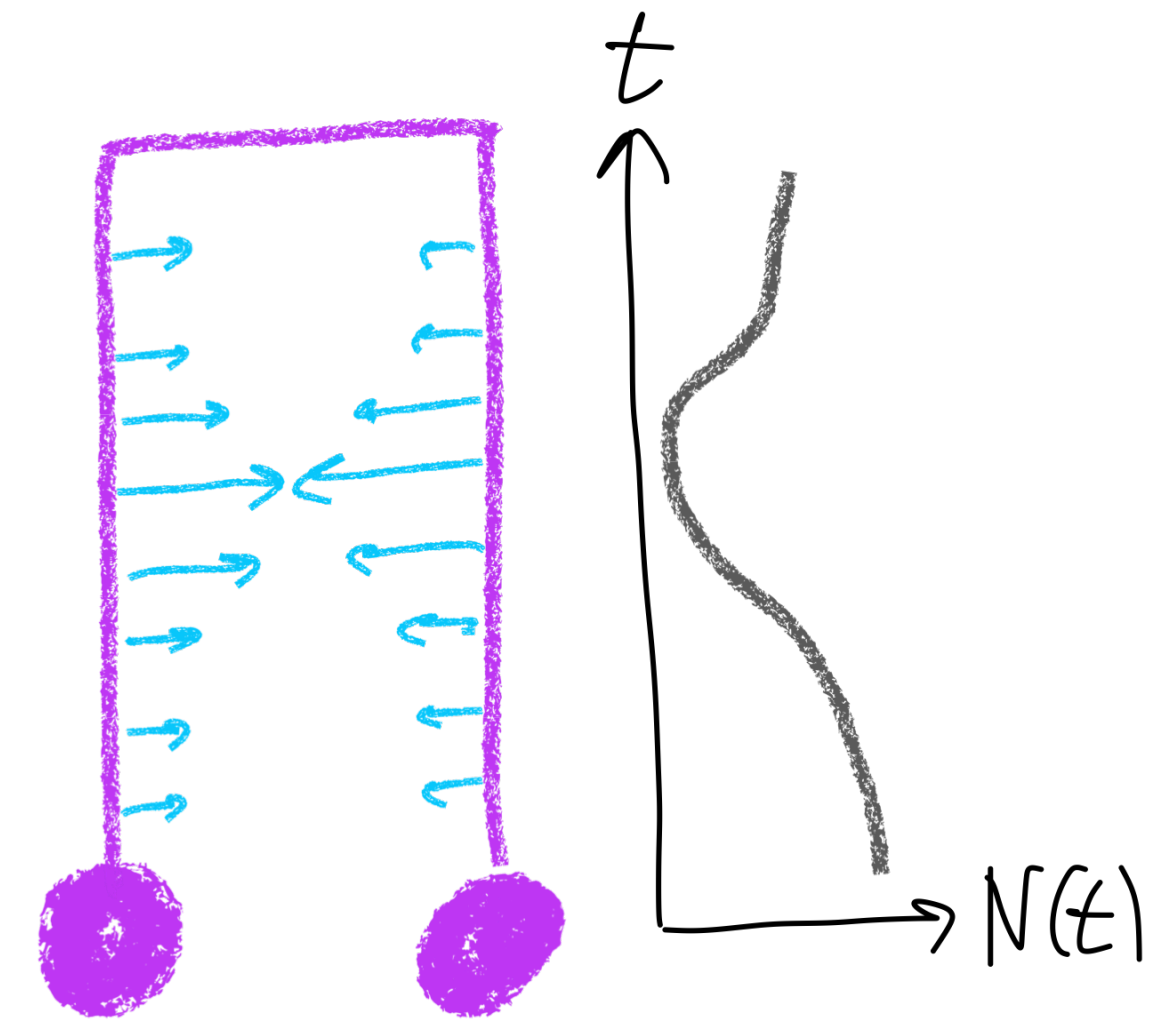
Population size determines coalescence rate

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

[Like students adding/dropping mid-quarter in Coalescent 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:

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

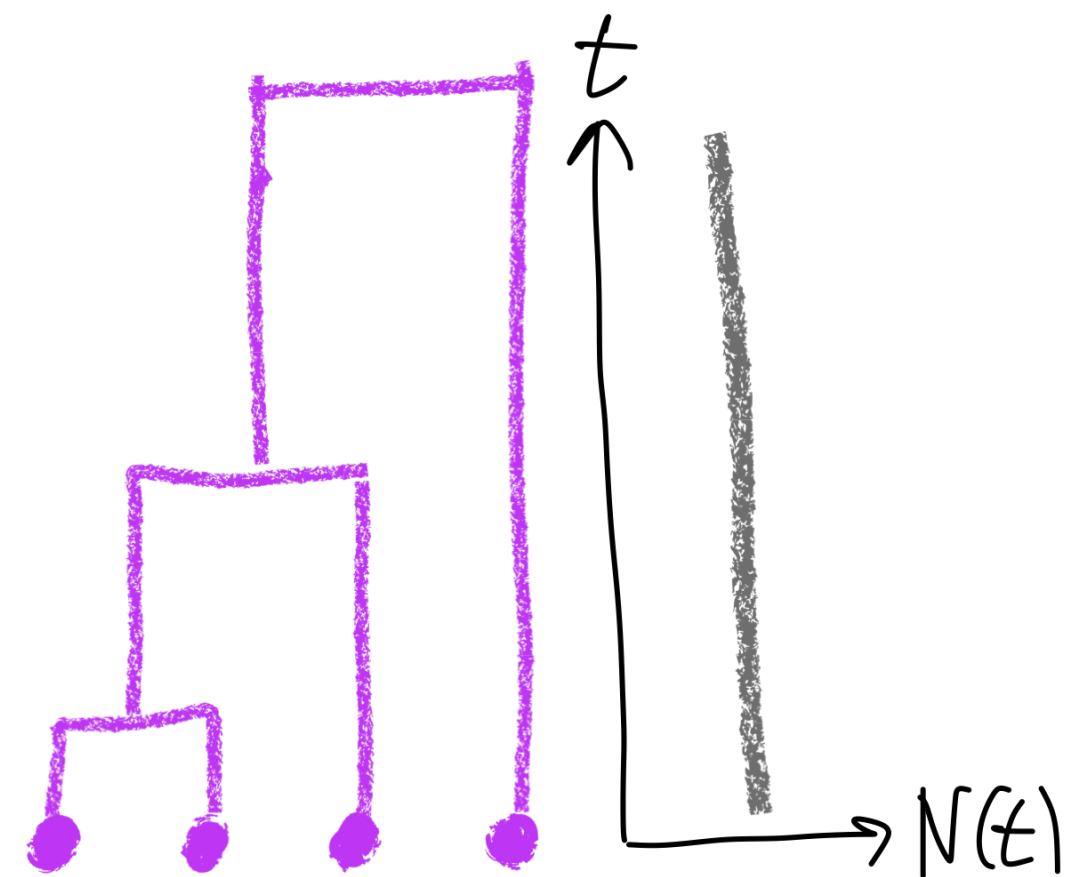
big $N \rightarrow p(t_i) = \frac{\binom{i}{2}}{2N(t_i)} \exp\left(-\binom{i}{2} \int_0^t \frac{ds}{2N(s)}\right)$

inhomogeneous Poisson process

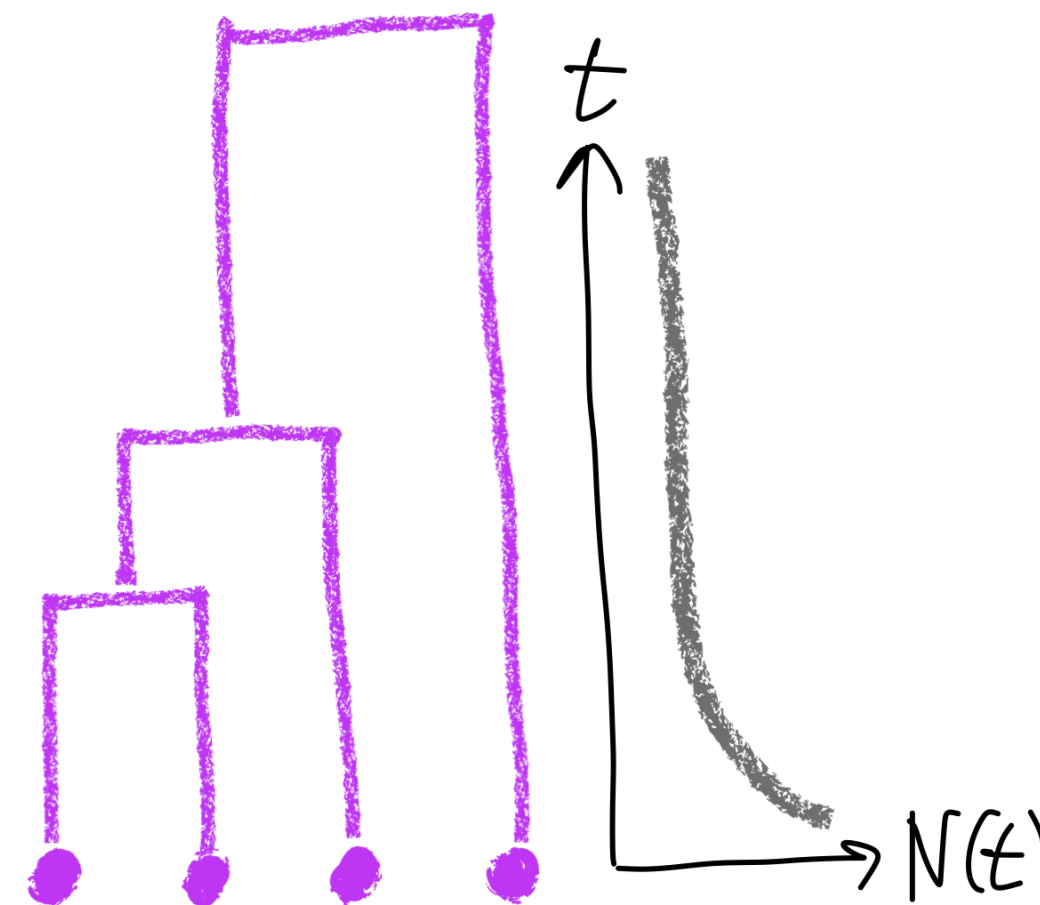
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Constant



Exponential growth



Bottleneck

