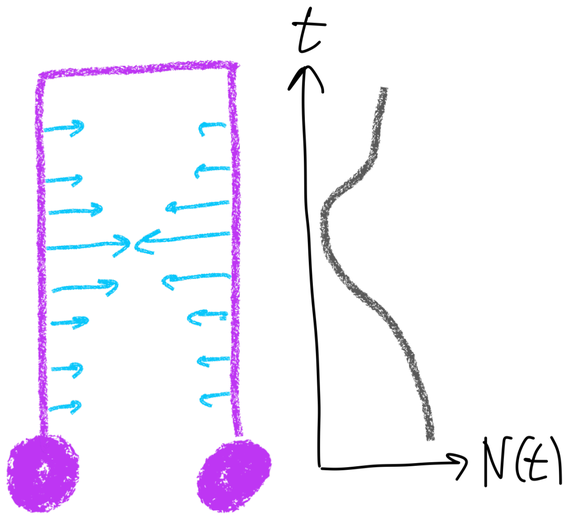
Previously on...

Population size determines coalescence rate

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



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

inhomogeneous Poisson process

Coalescent HMMs

Pairwise sequential Markov coalescent (PSMC)

Hidden state: T_{MRCA}

Emission: heterozygosity 00100110...

Transitions:

$$p(t|s) = \begin{cases} e^{-\rho s}, & s = t \\ (1-e^{-\rho s})\, q(t|s), & s \neq t \end{cases}$$

$\rho = 4Nr$

complicated integral of history $N(t)$