

# Microscale estimation of admixture timing

... and an example stochastic process for estimating it ... poorly.

## Why admixture timing?

Genetic data can provide estimates of the timing of mating between populations.

## Microscale vs macroscale



	Microscale	Macroscale
Water-wine illustration	drops of diluted wine	stream of wine entering glass
Population genetics	chromosome recombination	population migrations

## Why microscale estimation?

Mating and genetic recombination are microscale events. Genetic data provides evidence about the same empirical reality as other evidence, such as distinctive archaeological cultures in nearby settlements.



## References

Visit [castedo.com/doc/{151,153,154}](https://castedo.com/doc/{151,153,154}).

## What to estimate

**Lineal admixture time** is the microscale quantity to estimate.

Definitions

### lineal admixture time

the amount of time since fertilization of the first admixed individual in a lineage

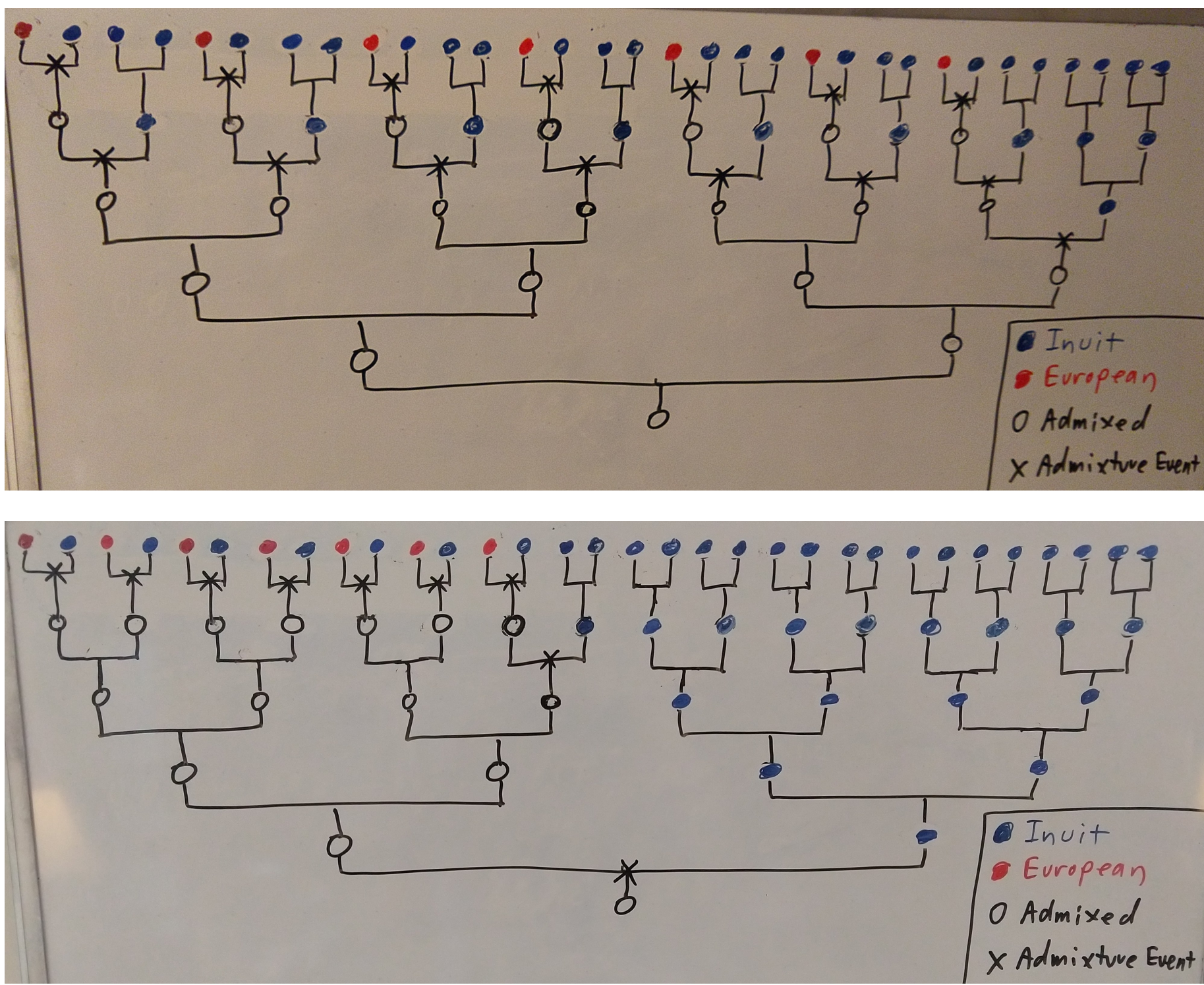
### lineage

single path of descent in the genealogy of an individual

### average lineal admixture time

average across all lineages of all individuals in a population

## Want to know lineal admixture times for these genealogies?



Request an **amazing** demonstration of calculating lineal admixture time at this poster now!

Learn more at [castedo.com/doc/151](https://castedo.com/doc/151)

## Acknowledgements

Special thanks to Hannah Moots and Benjamin Peter for constructive feedback on doc/151 about lineal admixture time and Steven Orzack for mentorship.

## Example Estimator

Estimate the **average lineal admixture time** as

$$\frac{1 - \phi}{\phi} (1 - \sum_i x_i^2)$$

where

$$x_i = \frac{1 - \sqrt{1 - 4\phi(1 - \phi)\alpha_i}}{2(1 - \phi)}$$

and  $\alpha_i$  is the frequency of alleles from the  $i$ -th ancestral group. Use

$$\phi = 1 - \frac{\beta}{2\alpha_0(1 - \alpha_0)}$$

if

- there are only two ancestral source populations and
- $\beta$  is the frequency of diploid loci with dual ancestry.

Learn more at [castedo.com/doc/154](https://castedo.com/doc/154)

## Example Stochastic Process

The example estimator is precisely the expected lineal admixture time under a stochastic process with the following assumptions:

- discrete time steps
- infinite population
- proportion  $\alpha_i$  of immigrants from  $i$ -th ancestral group
- fraction  $\phi$  of population is new non-admixed immigrants
- random mating (excluding new immigrants)
- stationary process

The underlying random object of this stochastic process is formally defined as a *gametic lineage*. For more details, visit [castedo.com/doc/153](https://castedo.com/doc/153).

## Further Research

- stochastic process for **good estimator**
- **software** for empirical researchers
- **data for validation** against historical evidence
- **data for new discoveries** about prehistory

Feedback & collaboration welcome!

