Input
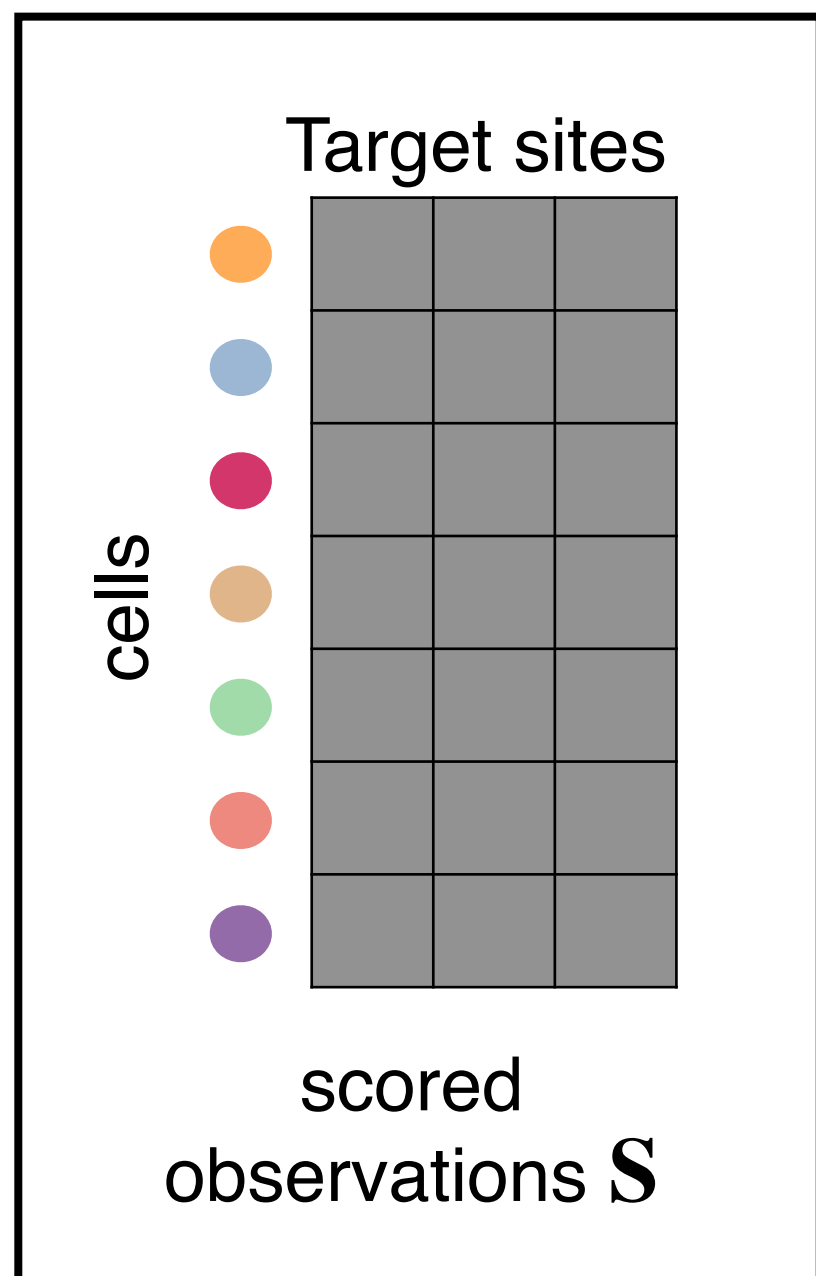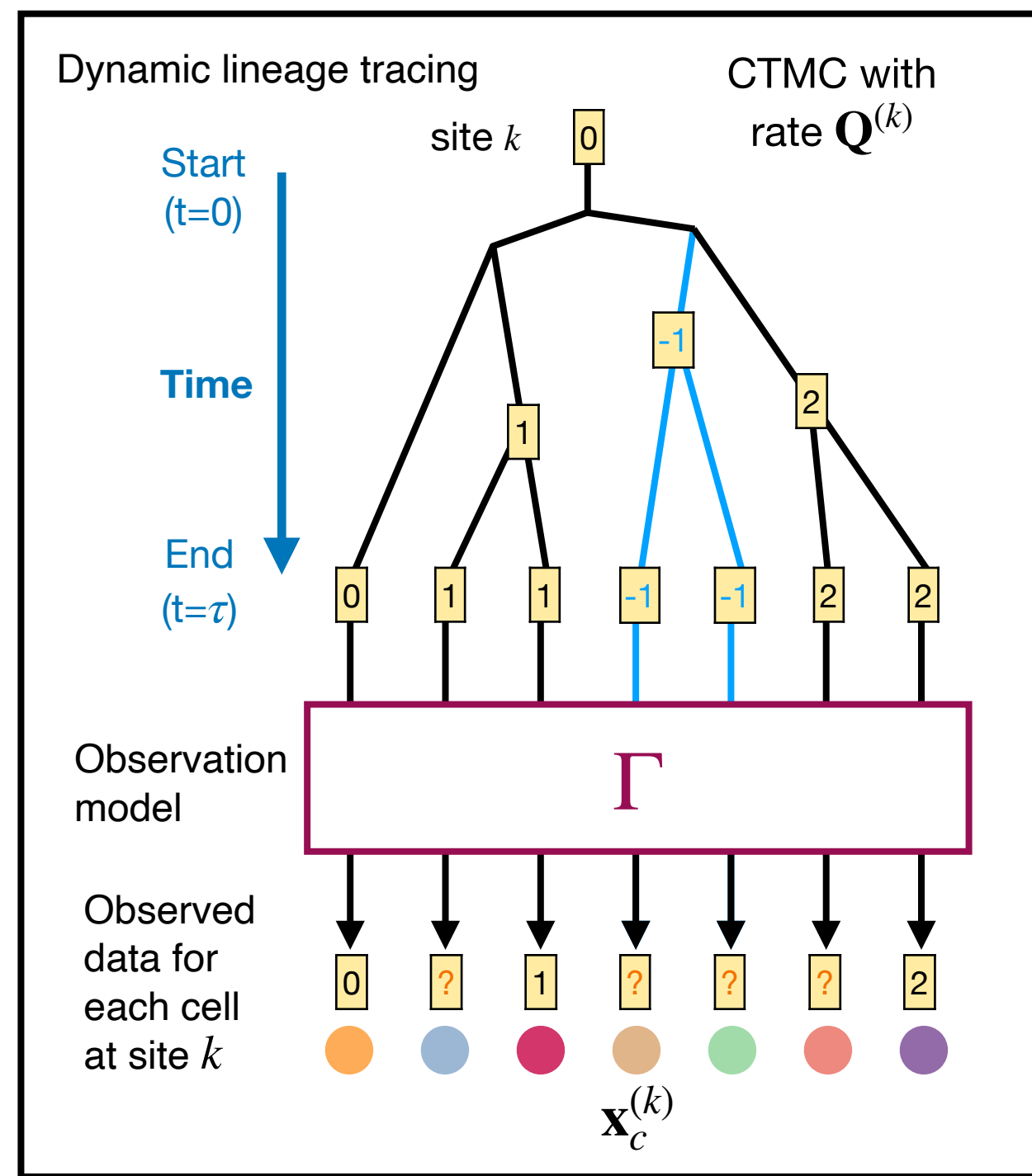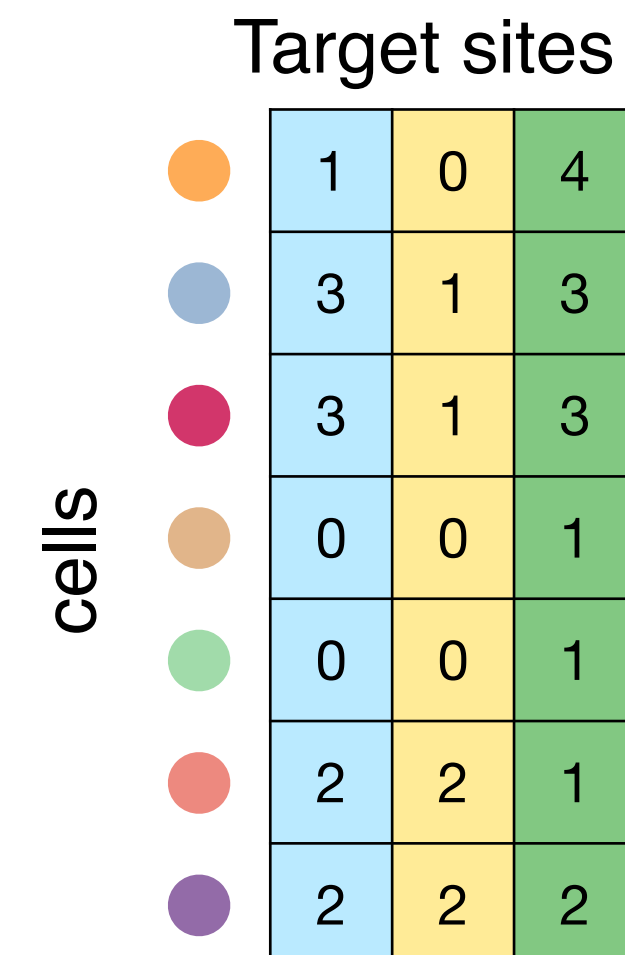
Target sites

cells

scored observations $\mathbf{S}$

🐫 **LAML-Pro**

maximum likelihood tree inference
$$\max_{T,\Theta} \log L(T, \Theta; \mathbf{D})$$
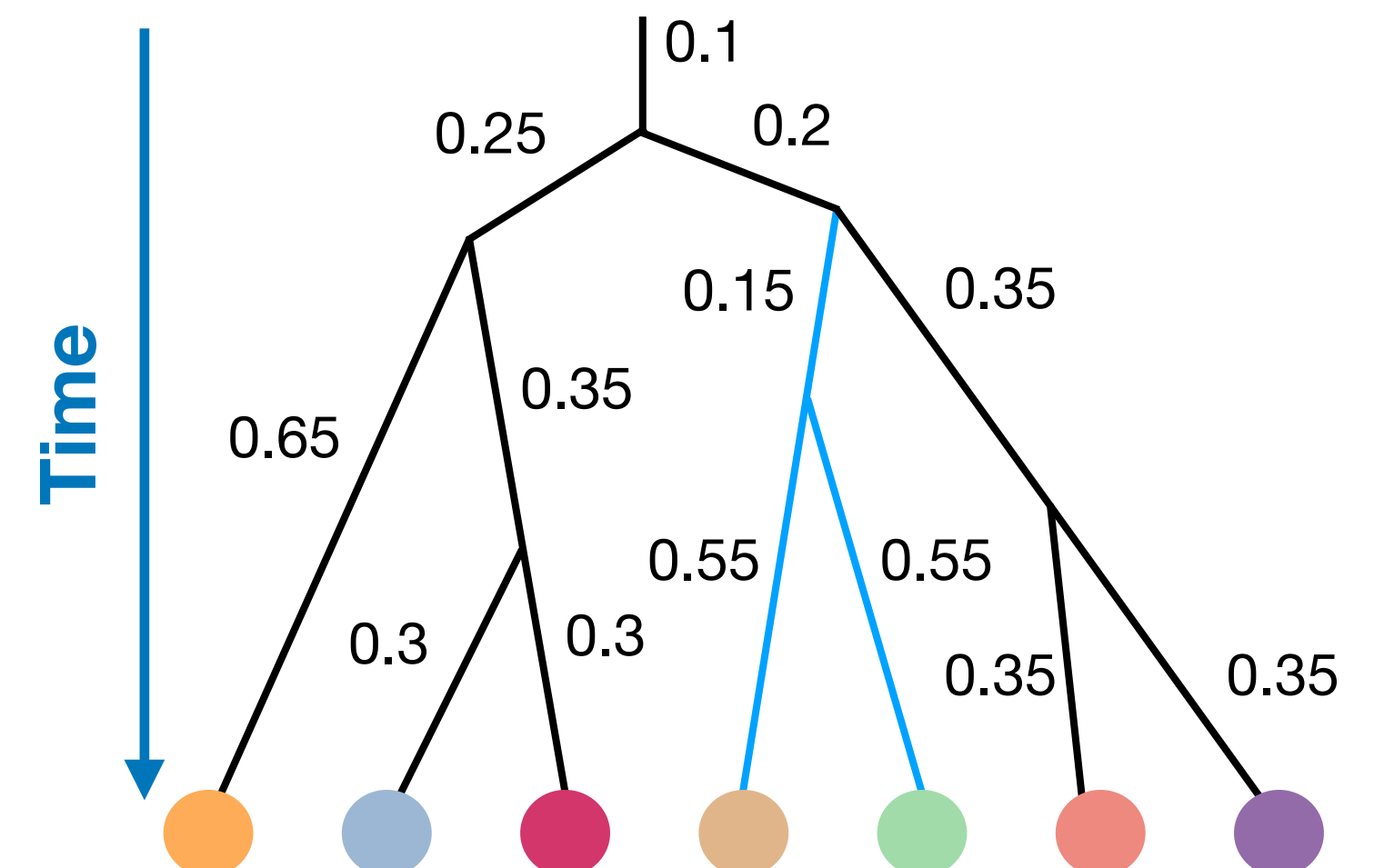
calculate $L(T, \Theta; \mathbf{D})$ under PMMO

Dynamic lineage tracing

site k

CTMC with rate $\mathbf{Q}^{(k)}$

Start (t=0)

Time

End (t=τ)

Observation model

Γ

Observed data for each cell at site k

$\mathbf{x}_c^{(k)}$

Output

(1) Imputed genotypes via entry-wise MAP on fixed tree

Target sites

cells

Time

(2) Time-resolved lineage tree

Time

(3) Mutation rate, heritable missing rate, and dropout rate