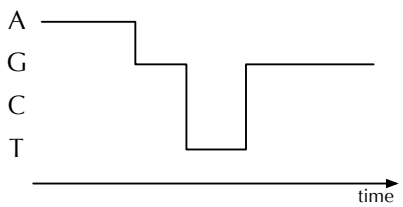
Jukes-Cantor DNA Evolution

	$\to A$	$\to G$	$\to C$	$\to T$
A	$1-3\epsilon$	ϵ	ϵ	ϵ
G	ϵ	$1-3\epsilon$	ϵ	ϵ
C	ϵ	ϵ	$1-3\epsilon$	ϵ
T	ϵ	ϵ	ϵ	$1-3\epsilon$



- Probability of mutation is O(**ε**) per generation.
- mutations will appear at rate of once every O(1/**ε**) generations.
- Measuring time in units of 1/**ε** leads to a continuous-time Markov chain.
- In each time step of length **ε**, total probability of a mutation is 3**ε**.

$$P = \begin{pmatrix} 1-3\epsilon & \epsilon & \epsilon & \epsilon \\ \epsilon & 1-3\epsilon & \epsilon & \epsilon \\ \epsilon & \epsilon & 1-3\epsilon & \epsilon \\ \epsilon & \epsilon & \epsilon & 1-3\epsilon \end{pmatrix} = I + \epsilon \begin{pmatrix} -3 & 1 & 1 & 1 \\ 1 & -3 & 1 & 1 \\ 1 & 1 & -3 & 1 \\ 1 & 1 & 1 & -3 \end{pmatrix}$$