

Rate matrix for an MG-style codon model

$$(\text{Rate})_{X,Y}(dt) = \begin{cases} \alpha & \pi_t dt & , \text{ one-step, synonymous substitution,} \\ \beta & \pi_t dt & , \text{ one-step, non-synonymous substitution,} \\ 0 & & , \text{ multi-step.} \end{cases}$$

$X, Y = \text{AAA...TTT}$ (excluding stop codons),
 π_t - frequency of the target nucleotide.

Example substitutions:

AAC → AAT (one step, synonymous - Asparagine)

CAC → GAC (one step, non-synonymous - Histidine to Aspartic Acid)

AAC → GTC (multi-step).

αR_{CT}
 βR_{CG}

α (syn. rate) and β (non-syn. rate) are the key quantities for all selection analyses

Illuminating the darkness in molecular evolution

