



asymmetric mutagenesis drives changes from the corners (losers: Phe, Cys, Trp, Gly, Val) to the center (gainers: Pro, His, Gln, Asn, Lys, Thr) of the genetic code

2<sup>nd</sup> base

$T_L \rightarrow C_L$   $A_L \leftarrow G_L$

$A_H$   $G_H$   $T_H$   $C_H$

1<sup>st</sup> base

Phe	TTT	TCT	Tyr	TAT	Cys	TGT
	TTC	TCC		TAC		TGC
Leu	TTA	TCA	Stop	TAA	Trp	TGA
	TTG	TCG		TAG		TGG
	CTT	CCT	His	CAT		CGT
Leu	CTC	CCC		CAC	Arg	CGC
	CTA	CCA	Gln	CAA		CGA
	CTG	CCG		CAG		CGG
Ile	ATT	ACT	Asn	AAT	Ser	AGT
	ATC	ACC		AAC		AGC
Met	ATA	ACA	Lys	AAA	Stop	AGA
	ATG	ACG		AAG		AGG
	GTC	GCT	Asp	GAT		GGT
Val	GTA	GCC		GAC	Gly	GGC
	GTG	GCA	Glu	GAA		GGA
	GTT	GCG		GAG		GGG

$\log_2(\text{rate from losers to gainers} / \text{rate from gainers to losers})$

