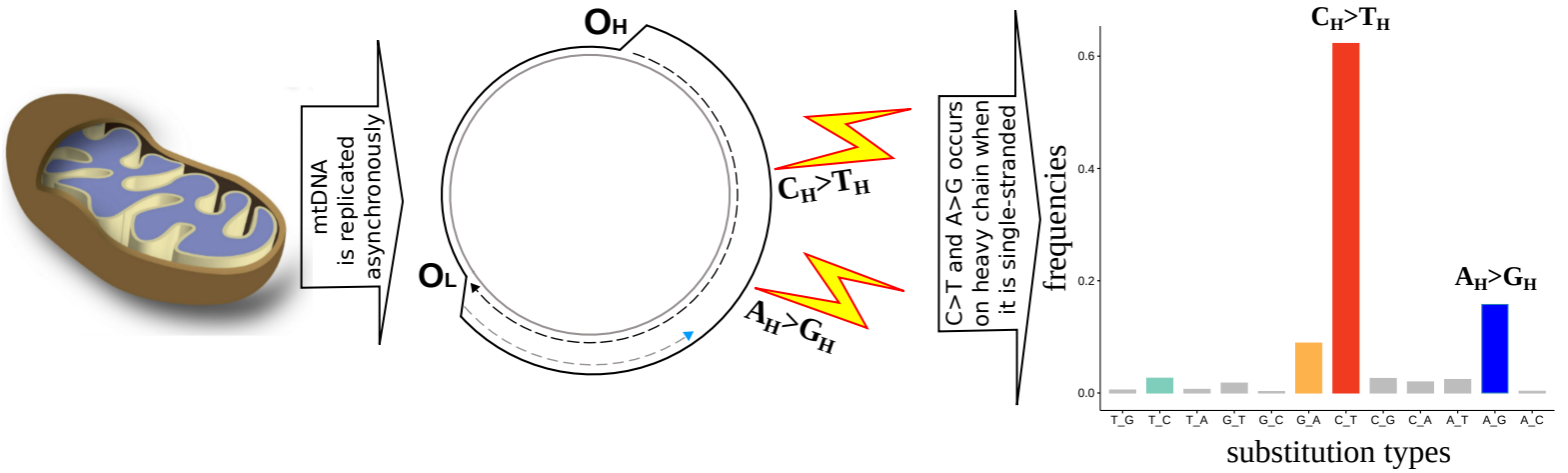

asymmetric mutagenesis drives changes from the corners (losers: Phe, Cys, Trp, Gly, Val) to the center (gainers: Pro, His, Gln, Asn, Lys, Thr) of the genetic code

expected direction from losers to gainers	CANCER DATA: expected: observed subst	expected: ancestral aminoacids	expected: forward rate	opposite to expected: observed subst	opposite to expected: ancestral aminoacids	opposite to expected: backward rate	Log2 (forward rate / backward rate)
LeuTT>SerTC	11	75	0.147	12	215	0.056	**1.394**
Tyr>His	62	124	0.5	10	97	0.103	**2.278**
LeuCT>Pro	303	547	0.554	23	214	0.107	**2.366**
Val>Ala	78	136	0.574	27	245	0.11	**2.38**
Gly>Asp	199	183	1.087	13	63	0.206	**2.398**
Trp>Arg	39	99	0.394	4	60	0.067	**2.563**
SerTC>Pro	138	215	0.642	21	214	0.098	**2.709**
Phe>SerTC	76	206	0.369	9	215	0.042	**3.14**
Cys>Arg	11	22	0.5	3	60	0.05	**3.322**
Ile>Thr	205	306	0.67	22	346	0.064	**3.397**
Cys>Tyr	30	22	1.364	13	124	0.105	**3.701**
Arg>His	57	60	0.95	7	97	0.072	**3.719**
Val>Ile	94	136	0.691	16	306	0.052	**3.725**
Gly>SerAG	167	183	0.913	3	48	0.062	**3.868**
SerAG>Asn	90	48	1.875	19	158	0.12	**3.963**
Val>Met	98	136	0.721	9	195	0.046	**3.965**
Phe>LeuCT	119	206	0.578	16	547	0.029	**4.304**
Ala>Thr	560	245	2.286	40	346	0.116	**4.305**
Met>Thr	98	195	0.503	7	346	0.02	**4.635**
Gly>Glu	145	183	0.792	1	77	0.013	**5.931**
Asp>Asn	90	63	1.429	3	158	0.019	**6.233**
Glu>Lys	128	77	1.662	1	93	0.011	**7.272**

human cancers, (similar results with human pathogenic mutations, human polymorphisms, polymorphisms of Chordata)

1st base

2nd base

1st base	2nd base: T_L / A_H	C_L / G_H	A_L / T_H	G_L / C_H
T_L / A_H	Phe TTT, Phe TTC, Leu TTA, Leu TTG	Ser TCT, Ser TCC, Ser TCA, Ser TCG	Tyr TAT, Tyr TAC, Stop TAA, Stop TAG	Cys TGT, Cys TGC, Trp TGA, Trp TGG
C_L / G_H	Leu CTT, Leu CTC, Leu CTA, Leu CTG	Pro CCT, Pro CCC, Pro CCA, Pro CCG	His CAT, His CAC, Gln CAA, Gln CAG	Arg CGT, Arg CGC, Arg CGA, Arg CGG
A_L / T_H	Ile ATT, Ile ATC, Met ATA, Met ATG	Thr ACT, Thr ACC, Thr ACA, Thr ACG	Asn AAT, Asn AAC, Lys AAA, Lys AAG	Ser AGT, Ser AGC, Stop AGA, Stop AGG
G_L / C_H	Val GTC, Val GTA, Val GTG, Val GTT	Ala GCT, Ala GCC, Ala GCA, Ala GCG	Asp GAT, Asp GAC, Glu GAA, Glu GAG	Gly GGT, Gly GGC, Gly GGA, Gly GGG

comparative species data: from bacteria to Chordata gainers are increasing and losers are decreasing