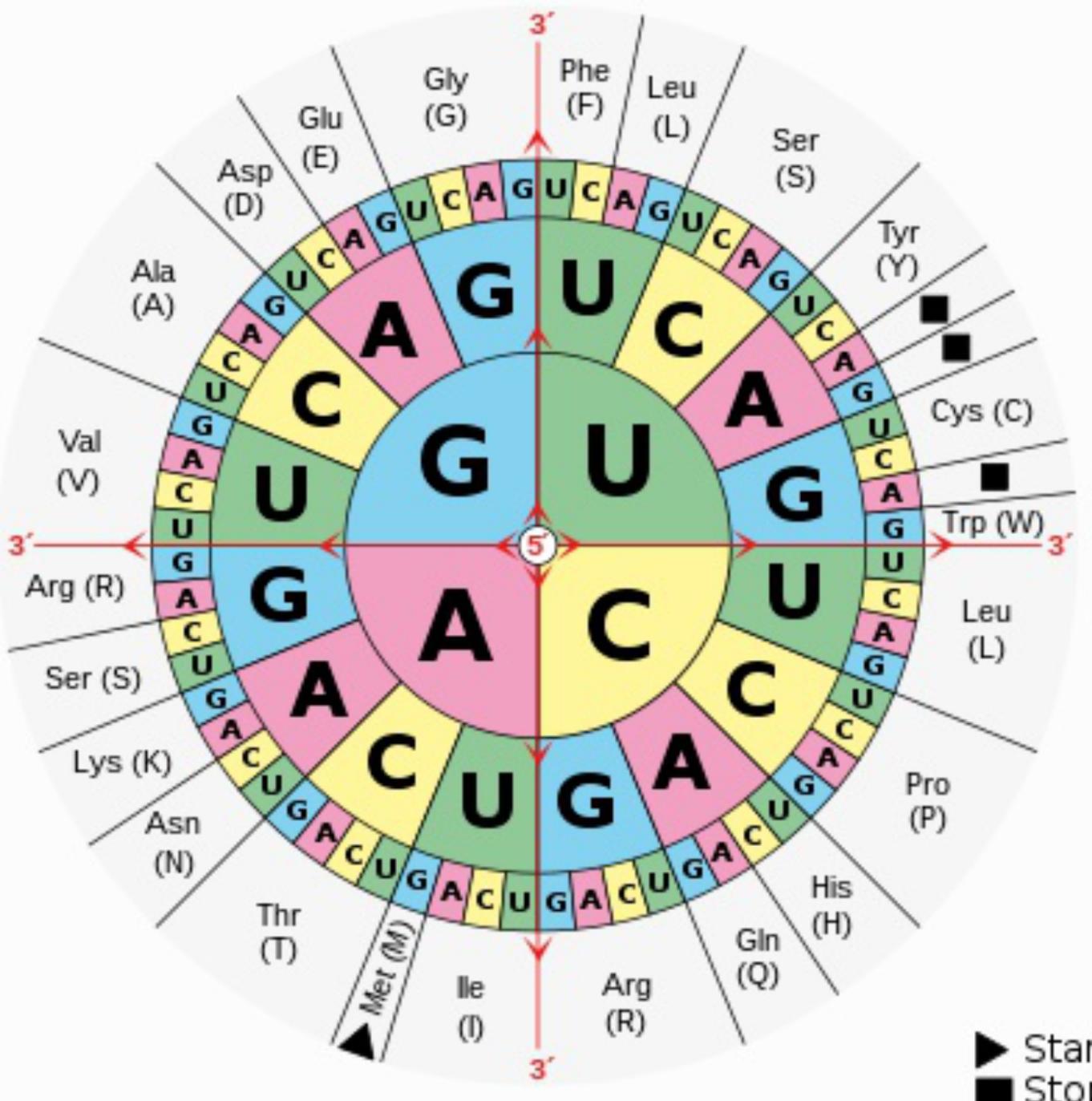


# Standard genetic code [1][10]

1st base	2nd base				3rd base
	U	C	A	G	
U	UUU (Phe/F) 8 UUC Phenylalanine ↑	UCU 8 UCC	UAU (Tyr/Y) 8 UAC Tyrosine ↑	UGU (Cys/C) 8 UGC Cysteine ↑	U U
	UUA	UCA (Ser/S) Serine ↑	UAA Stop (Ochre) 9 *[note 2]	UGA Stop (Opal) 9 *[note 2]	C C
	UUG → (Leu/L) Leucine	UCG	UAG Stop (Amber) 9 *[note 2]	UGG (Trp/W) 9 Tryptophan ↑	A G
	CUU ↑	CCU 6 CCC (Pro/P)	CAU (His/H) 8 CAC Histidine ‡	CGU	U U
	CUC	CCA Proline ↑	CAA (Gln/Q) 8 CAG Glutamine ↑	CGC (Arg/R) 6 CGA Arginine ‡	C C
	CUA	CCG	AAU (Asn/N) 8 AAC Asparagine ↑	CGG	A A
	CUG	ACU 6 ACC (Thr/T)	AAA (Lys/K) Lysine	AGU (Ser/S) Serine	G G
	AUU (Ile/I) Isoleucine	ACA Threonine ↑	AAC Asparagine ↑	AGC † 8 AGG Arginine ‡	U C
	AUC ↑	ACG	AAA (Lys/K) Lysine	AGA (Arg/R) 8 AGG Arginine ‡	A A
	AUA		AAG † 8		G G
	AUG → (Met/M) Methionine ↑				
G	GUU 6 GUC	GOU 6 GCC (Ala/A)	GAU (Asp/D) Aspartic acid	GGU	U U
	GUA (Val/V) Valine ↑	GCA Alanine ↑	GAC ↓ 8 GAA (Glu/E) Glutamic acid	GGC (Gly/G) 6 GGA Glycine ↑	C C A G
	GUG →	GCG	GAG ↓ 8	GGG	

$4^3 = 64$  base pairs for 20 amino acids

~ roughly 20 / 64 ~  $\frac{1}{3}$  of any mutation will be non-synonymous,



163 nonsynonymous mutations / 200 total mutations

81.5% nonsynonymous

## Single point mutations

U U U or U U C phenylalanine

U U C phenylalanine

A U U isoleucine

G U U Valine

C U U Leucine

U A U Tyrosine

U C U Serine

U G U Cysteine

U U C phenylalanine

U U G leucine

U U A leucine

8 / 10 missense →

nonsynonymous mutations

G U U G U C G U A G U G Valine

G U U Valine

U U U phenylalanine

A U U isoleucine

C U U Leucine

G A U aspartic acid

6 / 10 missense →

G C U Alanine

nonsynonymous mutations

G G U glycine

G U A Valine

G U C Valine

G U G Valine

A U U   A U C   A U A   Isoleucine

A U U   Isoleucine  
U U U   phenylalanine  
C U U   leucine  
G U U   valine  
A A U   asparagine  
A C U   threonine  
A G U   Serine  
A U A   Isoleucine  
A U C   Isoleucine  
A U G   methionine

7/10 missense →  
non synonymous  
mutations

A U G   methionine

A U G   methionine  
G U G   valine  
C U G   leucine  
U U G   leucine  
A G G   arginine  
A C G   threonine  
A A G   lysine  
A U C   isoleucine  
A U U   isoleucine  
A U A   isoleucine

9/10 missense →  
non synonymous  
mutations

UUA UUG Cuu Cuc CuA  
CUG leucine

UUA leucine

CuA leucine

AUA isoleucine

GUA valine

UGA STOP

UCA Serine

UAA STOP

UUG leucine

UUU phenylalanine

UUC phenylalanine

7/10 missense →

non synonymous

mutation ↗

2 are Stop codons