

The Genetic Codon Chart®

	U	C	A	G
U	UUU → Phe F (4) UUC → Phe F (4) UUA → Leu L (4) UUG → Leu L (4)	UCU → Ser S (4) UCC → Ser S (4) UCA → Ser S (4) UCG → Ser S (4)	UAU → Tyr Y (4) UAC → Tyr Y (4) UUA → Stop (4) UUG → Stop (4)	UGU → Cys C (4) UGC → Cys C (4) UGA → Stop (4) UGG → Trp W (4)
C	CUU → Leu L (4) CUC → Leu L (4) CUA → Leu L (4) CUG → Leu L (4)	CCU → Pro P (4) CCC → Pro P (4) CCA → Pro P (4) CCG → Pro P (4)	CAU → His H (4) CAC → His H (4) CAA → Gln Q (4) CAG → Gln Q (4)	CGU → Arg R (4) CGC → Arg R (4) CGA → Arg R (4) CGG → Arg R (4)
A	AUU → Ile I (3) AUA → Ile I (3) AUG → Met M (4)	ACU → Thr T (4) ACC → Thr T (4) ACA → Thr T (4) ACG → Thr T (4)	AAU → Asn N (4) AAC → Asn N (4) AAA → Lys K (4) AAG → Lys K (4)	AGU → Ser S (4) AGC → Ser S (4) AGA → Arg R (4) AGG → Arg R (4)
G	GUU → Val V (4) GUC → Val V (4) GUA → Val V (4) GUG → Val V (4)	GCU → Ala A (4) GCC → Ala A (4) GCA → Ala A (4) GCG → Ala A (4)	GAU → Asp D (4) GAC → Asp D (4) GAA → Glu E (4) GAG → Glu E (4)	GGU → Gly G (4) GGC → Gly G (4) GGA → Gly G (4) GGG → Gly G (4)

Amino Acid Properties
 Translation Start Codon: AUG
 Translation Stop Codon: UGA, UAG, UAA
 Hydrophobic / NonPolar: Phe, Leu, Ile, Val, Met, Ala, Gly, Pro, Thr, Ser, Asn, Lys, Gln, Arg, His, Cys, Tyr, Trp
 Hydrophilic / Polar: Ser, Thr, Asn, Lys, Gln, Arg, His, Cys, Tyr, Trp
 Positive Charge: Lys, Arg, His
 Negative Charge: Asp, Glu
 Cysteine: Cys
 Sulfur: Cys
 Aromatic: Phe, Tyr, Trp

Decoding Messenger RNA

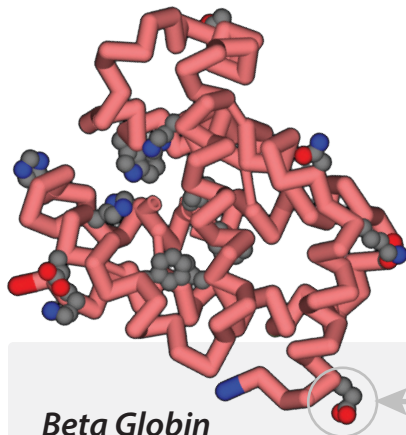
For Use With 3D Molecular Designs' **Genetic Codon Chart**



Proteins are made of unique sequences of **amino acids**. When building a protein, **DNA** is **transcribed** into **messenger RNA (mRNA)**, which is then **translated** into amino acids one **codon** (three mRNA bases) at a time.

Below is the **mRNA** sequence for the beginning of **beta globin**, a protein that carries oxygen in the blood. Using the codon chart to guide your work, complete the steps below:

1. Mark the **start codon** in the mRNA sequence
2. Underline each **codon** in the sequence
3. Translate the sequence into **amino acids**
4. Identify the **chemical properties** of each amino acid (see codon chart for recommended color scheme)
5. Translate the **Sickle Cell Mutation** and predict whether the mutation is **silent**, **missense**, or **nonsense**



Beta Globin Protein

← **Sickle Cell Mutation**

Messenger RNA

ACCAUGGUGCACCUGACUCCUGAGGAGAAG

start
codon

Amino Acid Sequence

M V H L T P E E K

T Sickle Cell Mutation

V Sickle Cell Mutation