

The Genetic Codon Chart®

	U	C	A	G
U	UUU → Phe F (46) UUC → Phe F (54) UUA → Leu L (41) UUG → Leu L (33)	UCU → Ser S (19) UCC → Ser S (22) UCA → Ser S (14) UUG → Stop (2)	UAU → Tyr Y (54) UAC → Tyr Y (54) UAA → Stop (2) UAG → Stop (2)	UGU → Cys C (3) UGC → Cys C (3) UGA → Stop (2) UGG → Trp W (5)
C	CUU → Leu L (33) CUC → Leu L (26) CUA → Leu L (7) CUG → Leu L (46)	CCU → Pro P (26) CCC → Pro P (78) CCA → Pro P (28) CCG → Pro P (3)	CAU → His H (42) CAC → His H (38) CAA → Gln Q (27) CAG → Gln Q (23)	CGU → Arg R (3) CGC → Arg R (3) CGA → Arg R (4) CGG → Arg R (6)
A	AUU → Ile I (36) AUC → Ile I (47) AUA → Ile I (12) AUG → Met M (24)	ACU → Thr T (25) ACC → Thr T (36) ACA → Thr T (26) ACG → Thr T (11)	AAU → Asn N (47) AAC → Asn N (53) AAA → Lys K (58) AAG → Lys K (3)	AGU → Ser S (55) AGC → Ser S (54) AGA → Arg R (4) AGG → Arg R (6)
G	GUU → Val V (18) GUC → Val V (24) GUA → Val V (13) GUG → Val V (46)	GCU → Ala A (27) GCC → Ala A (46) GCA → Ala A (28) GCG → Ala A (11)	GAU → Asp D (35) GAC → Asp D (44) GAA → Glu E (59) GAG → Glu E (3)	GGU → Gly G (3) GGC → Gly G (3) GGA → Gly G (4) GGG → Gly G (6)

Amino Acid Properties
 Translation Start Codon: Translation Stop Codon: Hydrophobic / NonPolar: Hydrophilic / Polar: Positive Charge: Negative Charge: Cysteine: Sulfur: Aromatic:

Decoding Messenger RNA

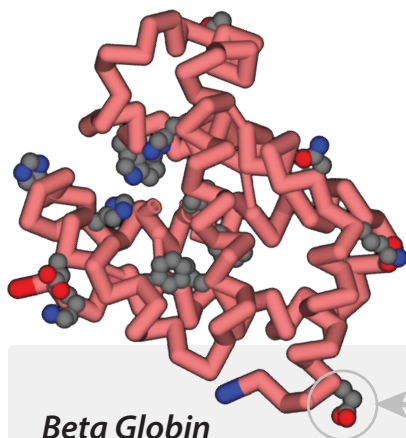
For Use with 3D Molecular Designs' **Genetic Codon Chart**



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

Amino Acid Sequence

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Sickle Cell Mutation