

# The Beta-Globin Gene Exercise

A “Paper Bioinformatics” Activity

The human beta-globin protein functions in transporting oxygen throughout our bodies. The sequence of the 146 amino acids that comprise this protein is encoded in a sequence of nucleotides that make up the beta-globin gene.

In this exercise, you are given the nucleotide sequence of a region of the human genome that contains the beta-globin gene, along with three possible amino acid sequences that can be encoded by one of the DNA strands.

***Find the nucleotide sequence in the DNA that encodes the amino acid sequence (given below) of the beta-globin protein.*** Using a highlighter, mark both the nucleotide sequence and the corresponding amino acid sequence that represents the beta-globin protein. You may wish to consult the attached Table of Codons and the one-letter abbreviation of each amino acid as you work on this exercise.

The amino acid sequence (using the one-letter abbreviation of each amino acid) of the beta-globin protein is:

**MVHLTPEEKSAVTALWGKVNVDEVGGEALGRLLVVYPWTQR  
FFESFGDLSTPDAMGNPKVKAHGKKVLGAFSDGLAHLDNL  
KGTFATLSELHCDKLHVDPENFRLLGNVLVCVLAHHFGKEF  
TPPVQAAYQKVVAGVANALAHKYH**

## The Standard Genetic Code

UUU	Phe	UCU	Ser	UAU	Tyr	UGU	Cys
UUC	Phe	UCC	Ser	UAC	Tyr	UGC	Cys
UUA	Leu	UCA	Ser	UAA	Stop	UGA	Stop
UUG	Leu	UCG	Ser	UAG	Stop	UGG	Trp
CUU	Leu	CCU	Pro	CAU	His	CGU	Arg
CUC	Leu	CCC	Pro	CAC	His	CGC	Arg
CUA	Leu	CCA	Pro	CAA	Gln	CGA	Arg
CUG	Leu	CCG	Pro	CAG	Gln	CGG	Arg
AUU	Ile	ACU	Thr	AAU	Asn	AGU	Ser
AUC	Ile	ACC	Thr	AAC	Asn	AGC	Ser
AUA	Ile	ACA	Thr	AAA	Lys	AGA	Arg
AUG	Met	ACG	Thr	AAG	Lys	AGG	Arg
GUU	Val	GCU	Ala	GAU	Asp	GGU	Gly
GUC	Val	GCC	Ala	GAC	Asp	GGC	Gly
GUA	Val	GCA	Ala	GAA	Glu	GGA	Gly
GUG	Val	GCG	Ala	GAG	Glu	GGG	Gly

AUG is part of the initiation signal, as well as being the codon for internal methionine.

## AMINO ACIDS

Name		Abbreviations	
1.	Alanine	Ala	<b>A</b>
2.	Arginine	Arg	<b>R</b>
3.	Asparagine	Asn	<b>N</b>
4.	Aspartic Acid	Asp	<b>D</b>
5.	Cysteine	Cys	<b>C</b>
6.	Glutamine	Gln	<b>Q</b>
7.	Glutamic Acid	Glu	<b>E</b>
8.	Glycine	Gly	<b>G</b>
9.	Histidine	His	<b>H</b>
10.	Isoleucine	Ile	<b>I</b>
11.	Leucine	Leu	<b>L</b>
12.	Lysine	Lys	<b>K</b>
13.	Methionine	Met	<b>M</b>
14.	Phenylalanine	Phe	<b>F</b>
15.	Proline	Pro	<b>P</b>
16.	Serine	Ser	<b>S</b>
17.	Threonine	Thr	<b>T</b>
18.	Tryptophan	Trp	<b>W</b>
19.	Tyrosine	Try	<b>Y</b>
20.	Valine	Val	<b>V</b>