

A 3DMD Paper BioInformatics Activity©

The β -Globin Gene Exercise

Student Handout

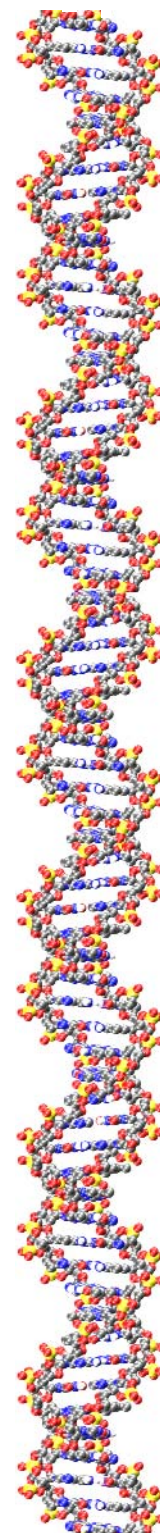
The human β -globin protein functions in transporting oxygen throughout our bodies. The sequence of the 147 amino acids that comprise the precursor protein is encoded in a sequence of nucleotides that make up the β -Globin Gene. The first amino acid (Met) is later removed to produce a 146 amino acid protein.

In this exercise, you are given a model of DNA. This model is a **Map** which contains the nucleotide sequence of the region of the human genome that contains the β -globin gene. In addition to the nucleotide sequence of both strands of DNA, you will find three possible amino acid sequences encoded in this DNA sequence. These are printed below the nucleotide sequence.

Using the map, find the nucleotide sequence in the DNA that encodes the amino acid sequence (given below) of the β -globin protein. Highlight (with a highlighter or white board marker) both the nucleotide sequence and the corresponding amino acid sequence on your map. You may wish to consult the Table of Codons and the one-letter abbreviation of each amino acid as you work on this exercise.

The amino acid sequence of the β -globin protein is shown below this paragraph. Please note that the *one-letter abbreviation* of each amino acid is used.

MVHLTPEEKSAVTALWGKVNVDDEVGGEALGRLLVVYPWTQRFFESFGDL
STPDAVMGNPKVKAHGKKVLGAFSDGLAHLNLIKGTFFATLSELHCDKLH
VDPENFRLLGNVLVCLAHHFGKEFTPPVQAAYQKVVAGVANALAHKYH



Standard Genetic Code

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	Name	Abbreviations
Alanine	Ala A	Leucine	Leu L
Arginine	Arg R	Lysine	Lys K
Asparagine	Asn N	Methionine	Met M
Aspartic Acid	Asp D	Phenylalanine	Phe F
Cysteine	Cys C	Proline	Pro P
Glutamine	Gln Q	Serine	Ser S
Glutamic Acid	Glu E	Threonine	Thr T
Glycine	Gly G	Tryptophan	Trp W
Histidine	His H	Tyrosine	Tyr Y
Isoleucine	Ile I	Valine	Val V

