AMINOGRAPHY

Dr. Janaki loved creating secret messages using proteins. She called it Aminography. She would use CRISPR to insert specific gene sub-sequences so that cells would be fooled into producing small harmless proteins that encoded a secret message. Here is an example of a gene sub-sequence she inserted once.

CGTACGATCGTAGCTAGCTAGTGCTACGCTGACTGCTAGTGCAT
CGTAGCATGGCCATTCTTTAAAGCTGACTACGTCTGAGCATCGA
TCGTGACGCTAGCTAGTACGTACGTAC

Can you find the secret protein message that this gene sub-sequence would create?

Here is what you need to know about protein synthesis to figure the message

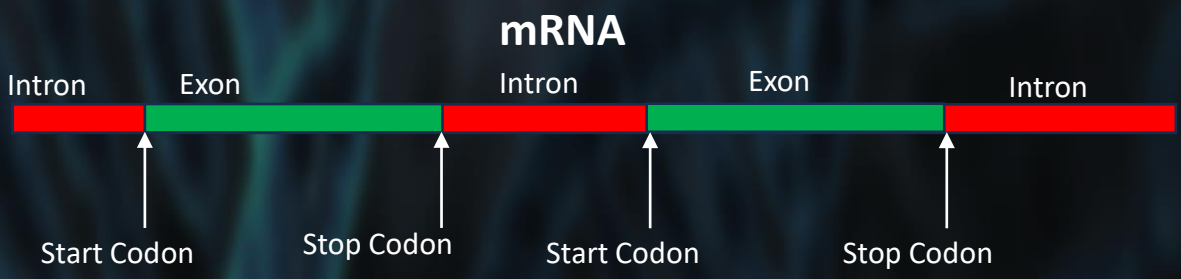
1. The gene-subsequence is first encoded into an mRNA (messenger RNA). An mRNA differs from the original DNA sub-sequence by only one change – T (Thymine) become U (Uracil).

2. The ribozome takes in an mRNA and creates a single protein made of a chain of sequence of amino acids (20 amino acids are given in the attached sheet for reference).

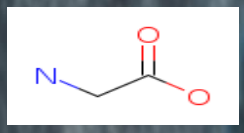
3. Each amino acid is created using a sequence of three nucleotides (also called a Codon) among A,G,C,U. Codons and the amino acids they generate are also provided in attached sheets in a table. Note that multiple codons may create the same amino acid e.g. the amino acid Proline can be created using any one of the four codons CCU, CCC, CCA, and CCG (see attached table).

4. Not all codons in the mRNA contribute to a protein. Only codons in the coding regions, also known as Exons contribute to a protein (see picture below).

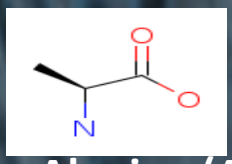
5. A coding region starts with a start codon – AUG and ends at a stop codon which can be either UAA, UAG,UGA.



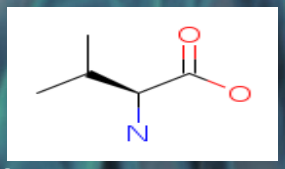
20 Amino Acids Structures



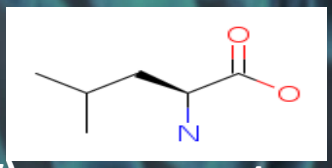
Glycine (Gly/G)



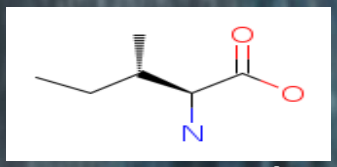
Alanine (Ala/A)



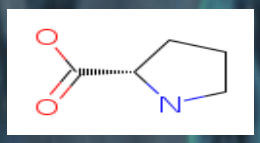
Valine (Val/V)



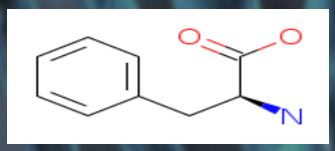
Leucine (Leu/L)



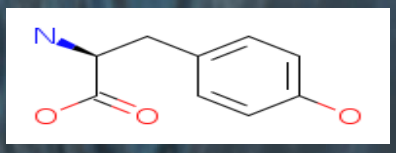
Isoleucine (Ile/L)



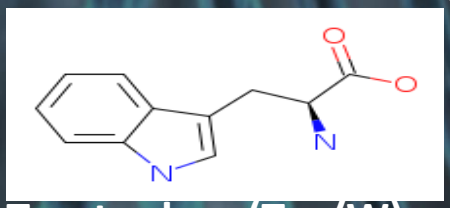
Proline (Pro/P)



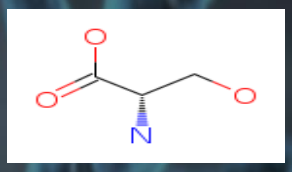
Phenylalanine (Phe/F)



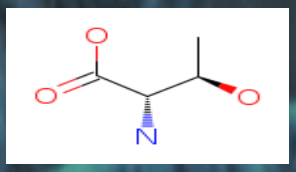
Tyrocine (Tyr/Y)



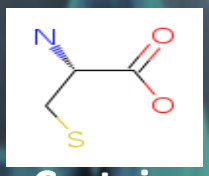
Tryptophan (Trp/W)



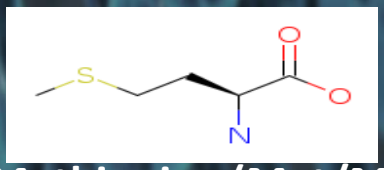
Serine (Ser/S)



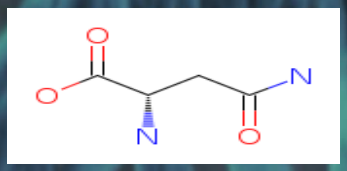
Threonine (Thr/T)



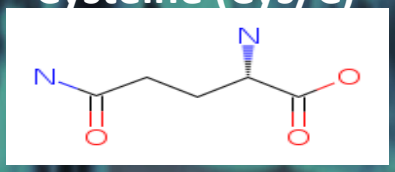
Cysteine (Cys/C)



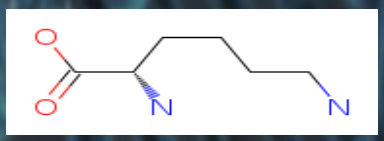
Methionine (Met/M)



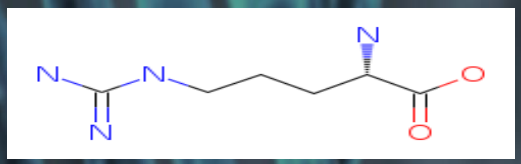
Asparagine (Asn/N)



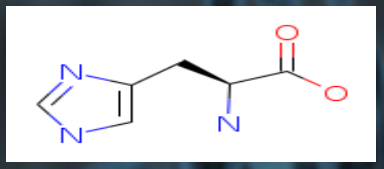
Glutamine (Gln/Q)



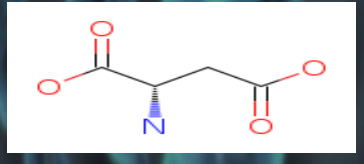
Lysine (Lys/L)



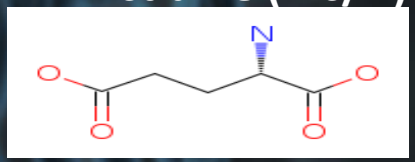
Arginine (Arg/R)



Histidine (His/H)



Aspartate (Asp/D)



Glutamate (Glu/D)

Codon To Amino Acid Table

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