INTRODUCTION:

Genes are the units that determine inherited characteristics, such as hair color and blood type. Genes are segments of DNA that code for proteins. The sequence of bases in DNA is the code that determines the sequence of amino acids, and thus the structure and function of proteins.

Protein synthesis starts in the **nucleus**. Here, the cell constructs a strand of mRNA from the DNA code of a particular gene. The mRNA message leaves the nucleus and goes to the **ribosome**, which will read the message to construct a *particular sequence of amino acids*

The mRNA message is read by the ribosome one **codon** (group of 3) at a time. Each codon codes for one of the 20 **amino acids**. Amino acids are joined by **peptide bonds**, and the process is complet when a *chain of amino acids* is released by the ribosome. The release happens when the ribosome reads a codon that signals a **STOP**.

Proteins gain their functional shapes by *bending*, *folding*, and *twisting* in a particular manner. The pattern of bending and folding depends *on the chemical properties of each amino acid.* It is the sequence of amino acids that determines how the protein will fold. Folding into the correct **shape** is essential for the **job** of the protein. Proteins are sensitive to changes in **pH** and **temperature**, which can disrupt the weak bonds that hold the protein into its shape, causing it to **denature** (unfold, untwist, and lose its shape) and become a *nonfunctional* amino acid chain.

1. What does each gene in your DNA code for?
2. Where does protein synthesis begin, and what takes place?
3. Where are proteins constructed in the cell?
4. What is a codon, and what does each codon code for?
5. What type of bond joins amino acids together?
6. When does the ribosome complete the chain of amino acids?
7. How do amino acid chains become functional proteins?
8. What would happen if there was a mistake in the amino acid sequence?...
9. What are some factors that can cause a protein to denature?

BUILD-A-SAM:

In this activity, you will simulate the mechanism of protein synthesis and thereby determine the traits inherited by a fictitious organism called **SAM**. SAM cells contain only one chromosome. This chromosome is made up of 8 genes (gene A, B, C, D, E, F, G, H and I). Each gene codes for a particular protein and thereby trait.

PROBLEM: * How can traits on a particular chromosome be determined?

* How can these traits determine the characteristics of an organism

PROCEDURE:

Gene A has been completed as an example. Notice the sequence of bases in the DNA. On the line provided *above*, write the *complementary sequence* of **DNA** bases (**REPLICATION**). On the line provided *below*, write the sequence of bases of **mRNA** that would be transcribed during **transcription** (DNA –> mRNA)**.** Then, on the next line, write the sequence of **amino acids** that are coded for by the ***mRNA codons*** (**TRANSLATION*).*** Use the amino acid sequence chart to determine the **trait** of your SAM. Draw a picture of your SAM using the traits coded for by its DNA. “Make” 2 additional genes that code for a trait of your choice to make your SAM unique.

BUILD-A-SAM

Gene A- *EXAMPLE*	**Gene B**	**Gene C**
DNA TGG - CCA - ATA	DNA TCG - GCT	DNA ____ - ____
DNA ACC - GGT - TAT	**DNA** AGC - CGA	**DNA** TTT - AAC
↓ *(codons)*	↓	
mRNA **UGG – CCA - AUA**	**mRNA** ____ ____	**mRNA** ____ ____
Amino Acid Sequence **TRP -PRO - MET**	**Amino Acid Sequence** ____ ____	**Amino Acid Sequence** ____ ____
Trait: **HAIRLESS**	**Trait**	**Trait**
Gene D	**Gene E**	**Gene F**
DNA ____ - _____ - ____	DNA _____ - ____ - ____ - ____	DNA _____ - ____ - ____
DNA GGA - . CGC - TCA	**DNA** GGG - AGG - . AAA - TCG	**DNA** ATG -. ATG - TCA
mRNA ____ ____ ____	**mRNA** ____ ____ ____ ____	**mRNA** ____ ____ ____
Amino Acid Sequence ____ ____ ____	**Amino Acid Sequence** ____ ____ ____ ____	**Amino Acid Sequence** ____ ____ ____
Trait	**Trait**	**Trait**

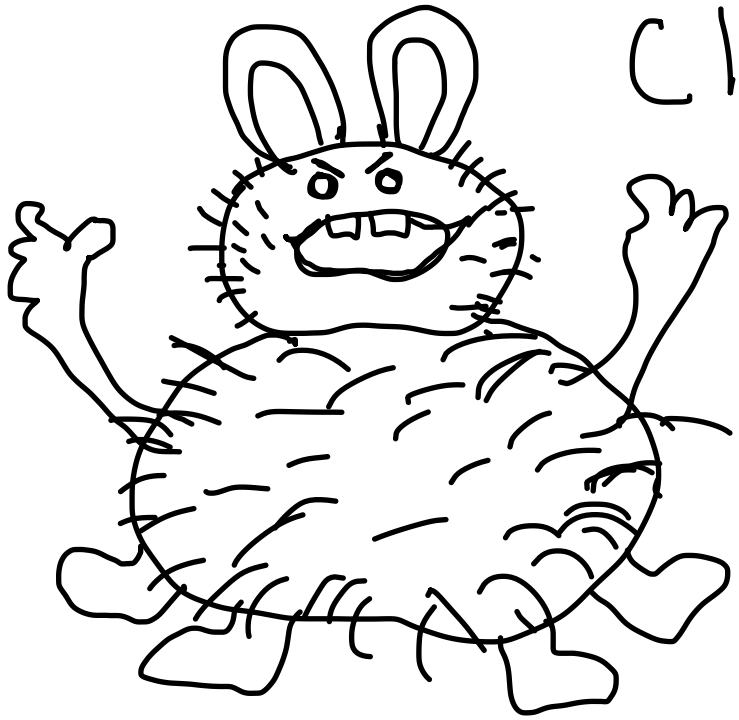
Amino Acid Sequence	Trait
TRP-PRO-MET	Hairless
TRP-PRO-VAL	Hairy
SER-ALA	Plump
SER-VAL	Skinny
LYS-LEU	Four-legged
LYS-VAL	Two-legged
PRO-ALA-ALA	Two teeth
PRO-ALA-SER	One tooth
PRO-SER-PHE-GLY	Big ears
PRO-SER-PHE-SER	Small ears
TYR-TYR-ASP	Grumpy face
TYR-TYR-SER	Cute face

Universal Genetic Code Chart
Messenger RNA Codons and the Amino Acids for Which They Code

FIRST BASE	SECOND BASE: U	SECOND BASE: C	SECOND BASE: A	SECOND BASE: G	THIRD BASE
U	UUU, UUC: PHE UUA, UUG: LEU	UCU, UCC, UCA, UCG: SER	UAU, UAC: TYR UAA, UAG: STOP	UGU, UGC: CYS UGA: STOP UGG: TRP	U C A G
C	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
A	AUU, AUC, AUA: ILE AUG: MET or START	ACU, ACC, ACA, ACG: THR	AAU, AAC: ASN AAA, AAG: LYS	AGU, AGC: SER AGA, AGG: ARG	U C A G
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

Drawing: Draw and NAME your SAM

NAME of SAM: Clyde



Create ***two additional traits*** to make your SAM unique. Create a **DNA sequence of 9 bases** and transcribe this into **mRNA codons**. Include the resulting amino acid sequence. **Then DRAW those 2 new traits on your SAM.**

GENE H	**GENE I**
DNA GTC TTA ACG	**DNA** CCC ATG AGT
mRNA CAG AAU UGC	**mRNA** GGG UAC UCA
Amino Acid Sequence: gln-asn-cys	**Amino Acid Sequence:** gly-tyr-ser
Trait: Green eyes	**Trait:** toe nails