DNA Transcription - Translation Activity

Critical Thinking Exercise

Organisms are made up of proteins that are, in turn, made up of amino acids. The amino acids needed for protein synthesis by each organism is encoded in their DNA. Using the processes of ***transcription*** and ***translation***, you can, theoretically start with a strand of DNA and calculate the amino acid chains for which an organism is coded.

DNA Strand → **Transcription to mRNA** → **Translation** → **Amino Acids Chain** → **Protein Synthesis**

In this activity, students will be given three strands of DNA. Using the different resources provided, they will determine the amino acids for which the DNA is coding and the organisms that would result from their protein synthesis.

Resources Needed:

1. **Transcription to Protein Synthesis** sheet
2. **Genetic Cod**e chart
3. **Amino Acid Building Blocks of Organisms** chart

Procedure:

1. Examine the three strands of DNA provided.
2. **Transcription**: On the worksheet, make the DNA strand into mRNA codons by writing the complimentary bases (review *Transcription to Protein Synthesis sheet*).
3. **Translation**: On the worksheet, using the **Genetic Code chart**, fill in the amino acids for each DNA strand.
4. **Organisms:** Using the to **Amino Acid Building Blocks of Organisms** chart, find which three organisms you have decoded.
5. In the last step, can you speculate what these three organisms represent?

Important Tip: Students should not use the tRNA anticodon when using the chart. It is the mRNA codon that carries the codon for a specific amino acid. The tRNA "anticodon" is the complement of the mRNA codon and it's job is to make sure to find the correct amino acid coded by mRNA to form the growing protein chain.

Next Generation Science Standards:

Disciplinary Core Ideas

LS1.A: Structure and Functions

• All cells contain genetic information in the form of DNA molecules. Genes are regions in the DNA that contain the instructions that code for the formation of proteins.

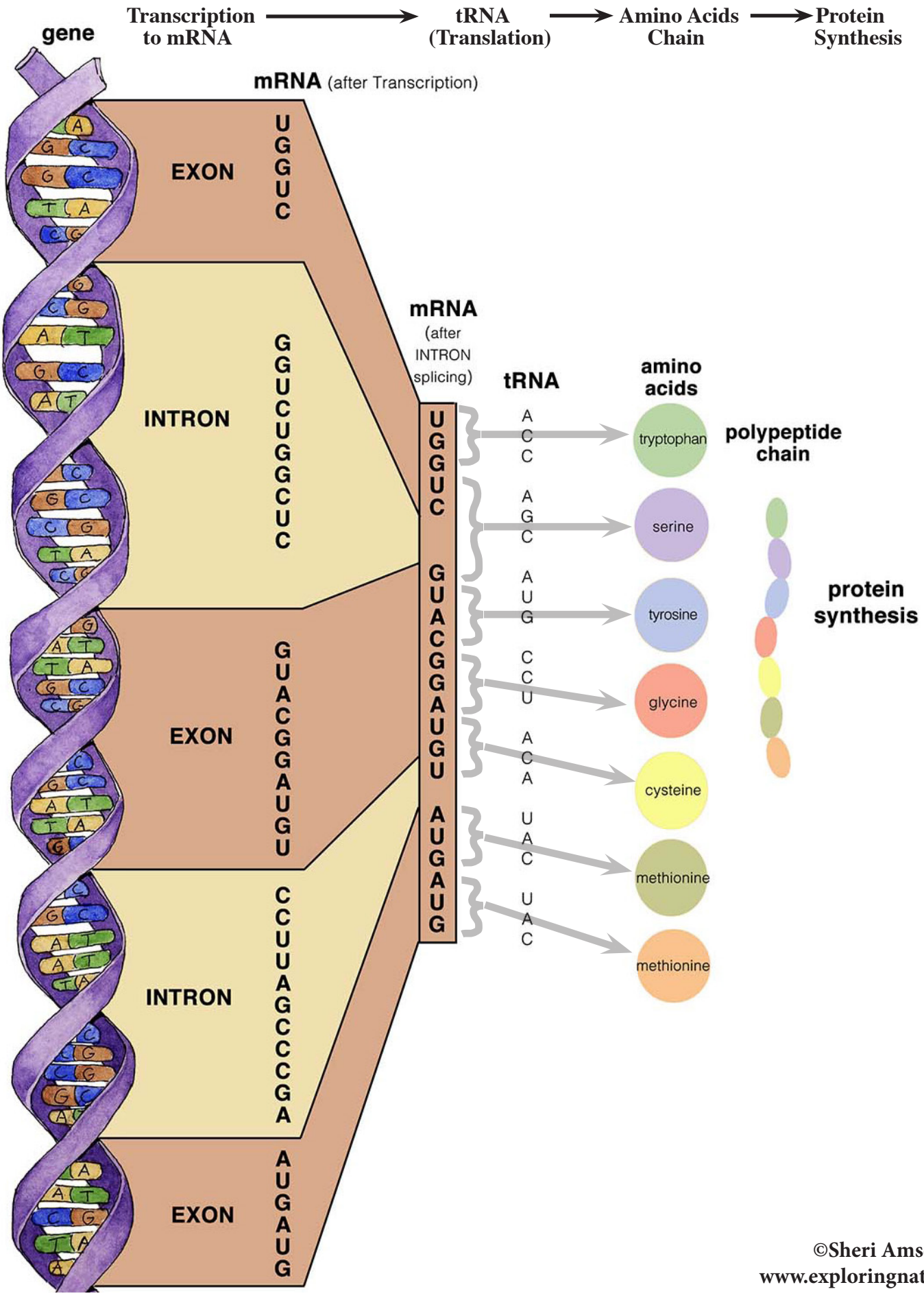
Performance Expectations - Students who demonstrate understanding can:

HS-LS3-1. Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring.

DNA Transcription - Translation Worksheet

DNA:	mRNA (Transcripion):	tRNA	Amino Acids:
Organism 1:			
AAA	___ ___ ___	___ ___ ___	_____
UCG	___ ___ ___	___ ___ ___	_____
ATG	___ ___ ___	___ ___ ___	_____
TGG	___ ___ ___	___ ___ ___	_____
Organism 2:			
CAC	___ ___ ___	___ ___ ___	_____
AAA	___ ___ ___	___ ___ ___	_____
ACA	___ ___ ___	___ ___ ___	_____
ATG	___ ___ ___	___ ___ ___	_____
ATA	___ ___ ___	___ ___ ___	_____
TTA	___ ___ ___	___ ___ ___	_____
GTA	___ ___ ___	___ ___ ___	_____
TTC	___ ___ ___	___ ___ ___	_____
TCC	___ ___ ___	___ ___ ___	_____
Organism 3:			
ATA	___ ___ ___	___ ___ ___	_____
TTA	___ ___ ___	___ ___ ___	_____
AAA	___ ___ ___	___ ___ ___	_____
ATG	___ ___ ___	___ ___ ___	_____
TTC	___ ___ ___	___ ___ ___	_____
ACA	___ ___ ___	___ ___ ___	_____
TCC	___ ___ ___	___ ___ ___	_____
GTA	___ ___ ___	___ ___ ___	_____

Transcription to Protein Synthesis



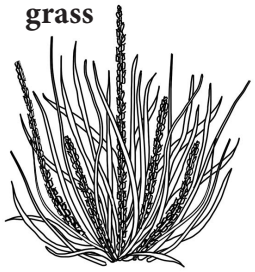
The Genetic Code – What Exactly is it?

Every strand of DNA has a chain of ***base pairs.*** The base pairs make up a code. This code names different ***amino acids*** for building proteins. Three bases together are called a ***codon*** and each codon spells out one amino acid. There are 64 possible codon combinations, but only 20 amino acids. The code has many overlaps. Many amino acids together build a specific ***protein***. This is called ***ß***
This is the **genetic code**.

The Genetic Code	
Amino Acids	**RNA Codons**
alanine	**GCU GCC GCA GCG**
arginine	**CGU CGC CGA CGG AGA AGG**
asparagine	**AAU AAC**
aspartic acid	**GAU GAC**
cysteine	**UGU UGC**
glutamic acid	**GAA GAG**
glutamine	**CAA CAG**
glycine	**GGU GGC GGA GGG**
histidine	**CAU CAC**
isoleucine	**AUU AUC AUA**
leucine	**UUA UUG CUU CUC CUA CUG**
lysine	**AAA AAG**
methionine	**AUG**
phenylalanine	**UUU UUC**
proline	**CCU CCC CCA CCG**
serine	**UCU UCC UCA UCG AGU AGC**
threonine	**ACU ACC ACA ACG**
tryptophan	**UGG**
tyrosine	**UAU UAC**
valine	**GUU GUC GUA GUG**
stop codons	**UAA UAG UGA**

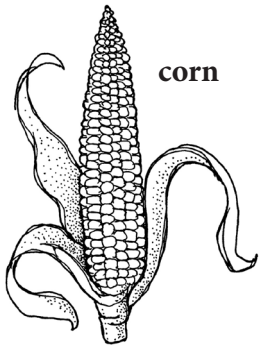
Amino Acid Building Blocks of Organisms

grass



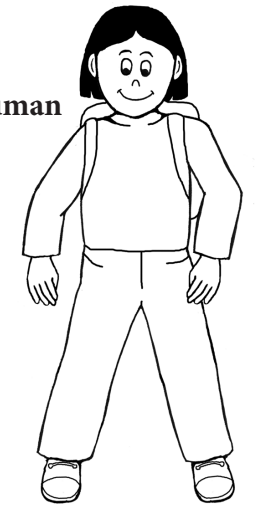
phenylalanine
serine
threonine
tyrosine

corn



histidine
isoleucine
leucine
lycine
methionine
phenylalanine
threonine
tryptophan
valine

human



asparagine
tyrosine
lysine
histidine
phenylalanine
threonine
cysteine
tyrosine

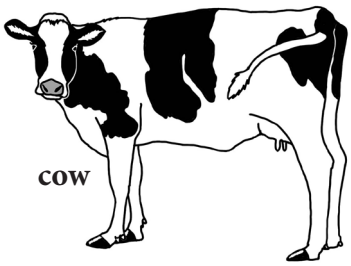
grasshopper

alanine
arginine
aspartic acid
cysteine
glutamic acid
glycine
histidine
isoleucine
leucine
lysine
methionine
phenylalanine
proline
serine
threonine
tyrosine
valine

wheat

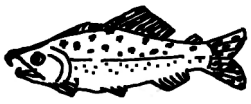
alanine
cysteine
glutamic acid
glycine
histidine
isoleucine
lysine
phenylalanine
proline
threonine
valine

cow



histidine
cysteine
tyrosine
lysine
asparagine
phenylalanine
threonine
tryptophan
valine

salmon



alanine
arginine
aspartic acid
cysteine
glutamic acid
glycine
histidine
isoleucine
leucine
lysine
methionine
phenylalanine
proline
serine
threonine
tryptophan
tyrosine
valine