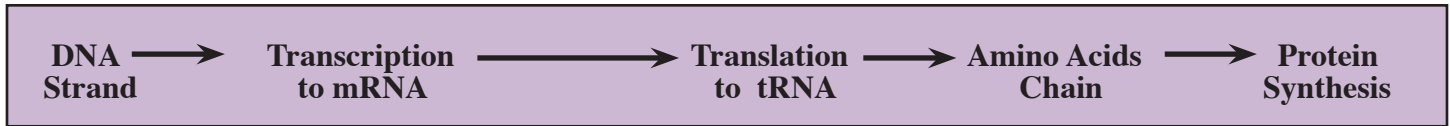


DNA Transcription - Translation Activity

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.



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 Code 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 (review **Transcription to Protein Synthesis sheet**).
3. **Translation:** On the worksheet, make the mRNA codons into tRNA codons (review **Transcription to Protein Synthesis sheet**).
3. **Amino Acid Chains:** Using the **Genetic Code chart**, fill in the amino acids for each DNA strand.
4. **Organisms:** Using the **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?

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 (Transcription): tRNA Codons (Translation): Amino Acids:

Organism 1:

AAA	___ ___ ___	___ ___ ___	_____
UCG	___ ___ ___	___ ___ ___	_____
ATG	___ ___ ___	___ ___ ___	_____
TGG	___ ___ ___	___ ___ ___	_____

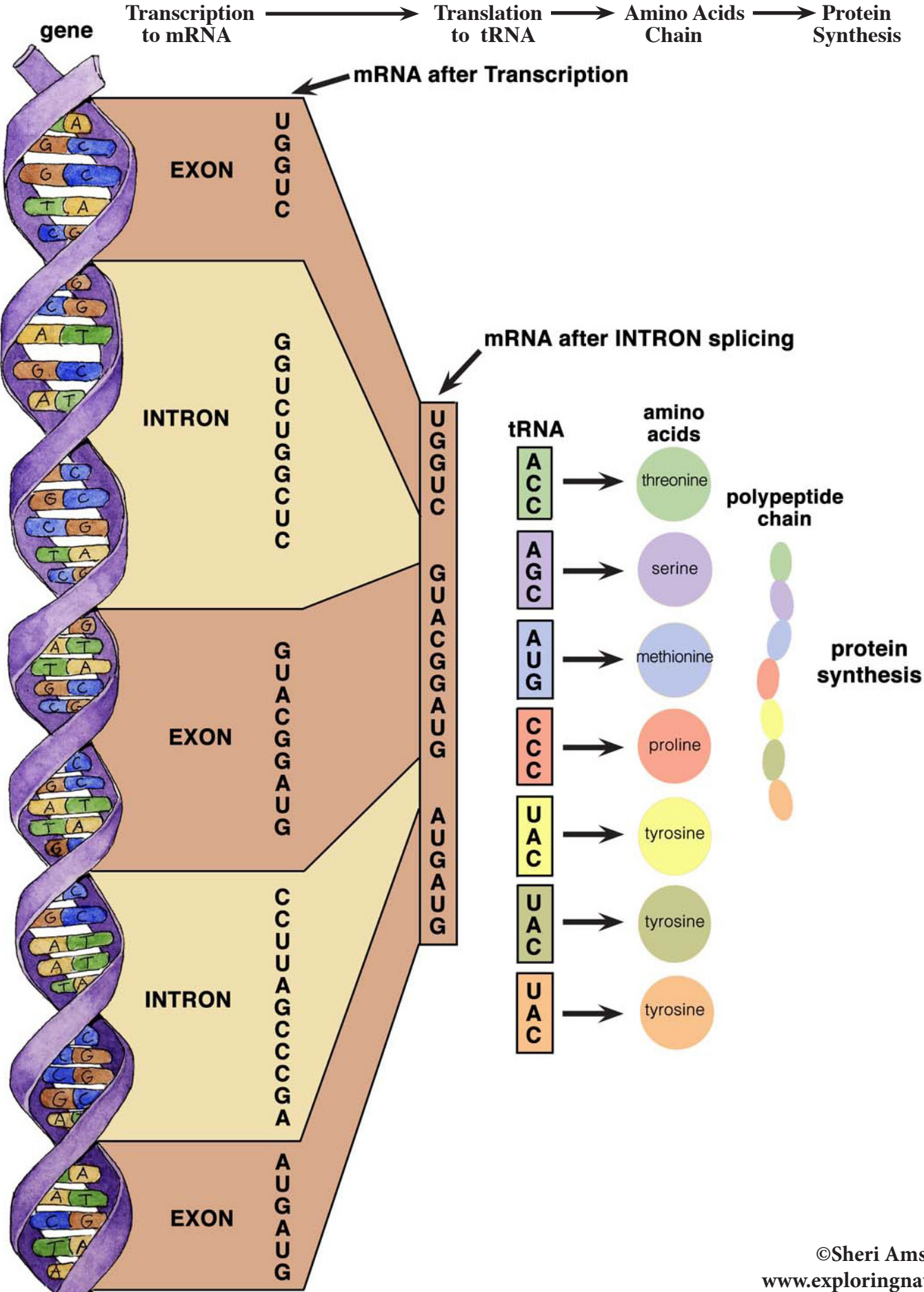
Organism 2:

CAC	___ ___ ___	___ ___ ___	_____
AAA	___ ___ ___	___ ___ ___	_____
ACA	___ ___ ___	___ ___ ___	_____
ATG	___ ___ ___	___ ___ ___	_____
ATA	___ ___ ___	___ ___ ___	_____
TTA	___ ___ ___	___ ___ ___	_____
GTA	___ ___ ___	___ ___ ___	_____
TTC	___ ___ ___	___ ___ ___	_____
TCC	___ ___ ___	___ ___ ___	_____

Organism 3:

ATA	___ ___ ___	___ ___ ___	_____
TTA	___ ___ ___	___ ___ ___	_____
AAA	___ ___ ___	___ ___ ___	_____
ATG	___ ___ ___	___ ___ ___	_____
TTC	___ ___ ___	___ ___ ___	_____
ACA	___ ___ ___	___ ___ ___	_____
TCC	___ ___ ___	___ ___ ___	_____
GTA	___ ___ ___	___ ___ ___	_____

Transcription to Protein Synthesis



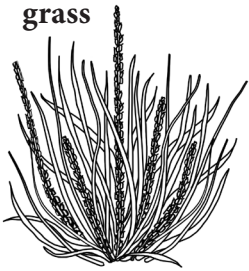
The Genetic Code – What Exactly is it?

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 *protein synthesis*. 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

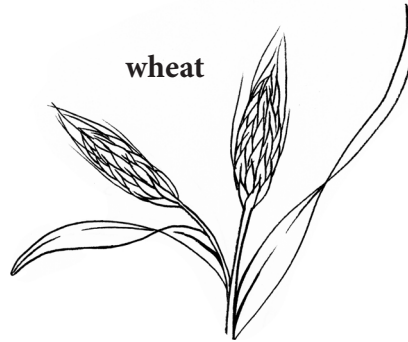
Amino Acid Building Blocks of Organisms

grass



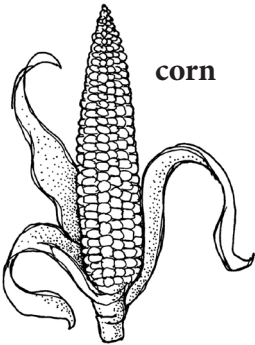
cysteine
lysine
methionine
tryptophan

wheat



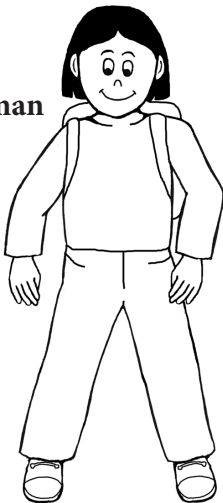
alanine
cysteine
glutamic acid
glycine
histidine
isoleucine
lysine
phenylalanine
proline
threonine
valine

corn



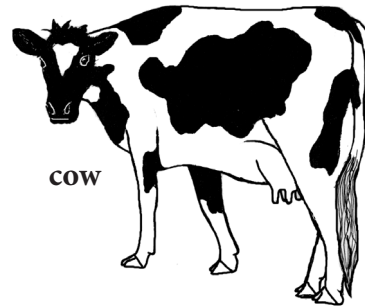
histidine
isoleucine
leucine
lysine
methionine
phenylalanine
threonine
tryptophan
valine

human



isoleucine
leucine
lysine
methionine
phenylalanine
threonine
tryptophan
valine

cow



histidine
isoleucine
leucine
lysine
methionine
phenylalanine
threonine
tryptophan
valine

grasshopper



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

salmon



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

DNA Transcription - Translation Critical Thinking Exercise KEY

DNA → mRNA (Transcription) → tRNA Codons (Translation) → Amino Acids → Organism

AAA	UUU	AAA, AAG	lysine	Grass
UCG	AGC	UCG, UGU	cysteine	
ATG	UAC	AUG	methionine	
TGG	ACC	UGG	tryptophan	
CAC	GUG	CAC, CAU	histidine	Cow
AAA	UUU	AAA, AAG	lysine	
ACA	UGU	ACA, ACC, ACG, ACU	threonine	
ATG	UAC	AUG	methionine	
ATA	UAU	AUA, AUC, AUU	isoleucine	
TTA	AAU	UUA, UUG, CUA, CUC, CUG, CUU	leucine	
GTA	CAU	GUA, GUC, GUG, GUU	valine	
TTC	AAG	UUC, UUU	phenylalanine	
TCC	ACC	UGG	tryptophan	
ATA	UAU	AUA, AUC, AUU	isoleucine	Human
TTA	AAU	UUA, UUG, CUA, CUC, CUG, CUU	leucine	
AAA	UUU	AAA, AAG	lysine	
ATG	UAC	AUG	methionine	
TTC	AAG	UUC, UUU	phenylalanine	
ACA	UGU	ACA, ACC, ACG, ACU	threonine	
TCC	ACC	UGG	tryptophan	
GTA	CAU	GUA, GUC, GUG, GUU	valine	

The Genetic Code	
Amino Acids	RNA Codons
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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

