

## Transcription and Translation

A Few Words on DNA

DNA Thymine  
Base Pairs Genes  
Cytosine RNA  
Guanine Uracil  
Adenine

Bill Nye The Science Guy!



A Few Words on DNA

DNA Thymine  
Base Pairs Genes  
Cytosine RNA  
Guanine Uracil  
Adenine

### Activity Directions – Step 1

- ▶ Match the mRNA base pairs with the DNA template provided.  
(insert example picture)

### Activity Directions – Step 2

- ▶ Match the tRNA base pairs to the mRNA strand that you just created.

(Sample picture)

### Activity Directions – Step 3

- Using the chart on the board, match the tRNA bases to the corresponding amino acid.

First base	Second base				Third base
	U	C	A	G	
U	UUU Phenylalanine	UCU Serine	UAU Tyrosine	UUU Cysteine	U
	UUC Phenylalanine	UCC Serine	UAC Tyrosine	UUC Cysteine	C
	UUA Leucine	UCA Serine	UAA Stop	UGA Stop	A
C	CUU Leucine	CCU Proline	CAU Histidine	CGU Arginine	U
	CUC Leucine	CCC Proline	CAC Histidine	CGC Arginine	C
	CUA Leucine	CCA Proline	CAG Glutamine	CGA Arginine	A
A	AUU Isoleucine	AUC Isoleucine	AUA Isoleucine	AUG Methionine	M
	AUA Isoleucine	AUA Isoleucine	AUA Isoleucine	AUA Isoleucine	A
	AUG Start/Methionine	AUG Threonine	AAC Asparagine	AAU Asparagine	N
G	GUU Valine	GCU Alanine	GAU Aspartic Acid	GGU Glycine	U
	GUC Valine	GCC Alanine	GAC Aspartic Acid	GGC Glycine	C
	GUA Valine	GCA Alanine	GAA Glutamic Acid	GGA Glycine	A
S	GUU Valine	GCU Alanine	GAU Aspartic Acid	GGU Glycine	U
	GUC Valine	GCC Alanine	GAC Aspartic Acid	GGC Glycine	C
	GUA Valine	GCA Alanine	GAA Glutamic Acid	GGA Glycine	A

Legend:   
     Cysteine   
     Tyrosine   
     Stop   
     Methionine

Copyright © 2004 Pearson Education, Inc.

### Activity Directions – Step 4

- Using the chart on the board, match the tRNA bases to the corresponding amino acid.
- REMEMBER:** amino acids correspond with a set of three bases. These base triplets are called **codons**.

First base	Second base				Third base
	U	C	A	G	
U	UUU Phenylalanine	UCU Serine	UAU Tyrosine	UUU Cysteine	U
	UUC Phenylalanine	UCC Serine	UAC Tyrosine	UUC Cysteine	C
	UUA Leucine	UCA Serine	UAA Stop	UGA Stop	A
C	CUU Leucine	CCU Proline	CAU Histidine	CGU Arginine	U
	CUC Leucine	CCC Proline	CAC Histidine	CGC Arginine	C
	CUA Leucine	CCA Proline	CAG Glutamine	CGA Arginine	A
A	AUU Isoleucine	AUC Isoleucine	AUA Isoleucine	AUG Methionine	M
	AUA Isoleucine	AUA Isoleucine	AUA Isoleucine	AUA Isoleucine	A
	AUG Start/Methionine	AUG Threonine	AAC Asparagine	AAU Asparagine	N
G	GUU Valine	GCU Alanine	GAU Aspartic Acid	GGU Glycine	U
	GUC Valine	GCC Alanine	GAC Aspartic Acid	GGC Glycine	C
	GUA Valine	GCA Alanine	GAA Glutamic Acid	GGA Glycine	A
S	GUU Valine	GCU Alanine	GAU Aspartic Acid	GGU Glycine	U
	GUC Valine	GCC Alanine	GAC Aspartic Acid	GGC Glycine	C
	GUA Valine	GCA Alanine	GAA Glutamic Acid	GGA Glycine	A

Legend:   
     Cysteine   
     Tyrosine   
     Stop   
     Methionine

Copyright © 2004 Pearson Education, Inc.

### Activity Directions

- If you have any questions while you are working, just raise your hand.
- If you finish early, check over your work. After that, you may read quietly until every group is finished.

### Activity Directions

What is the first step?

### Activity Directions

- Match the mRNA base pairs with the DNA template provided.
- Match the tRNA base pairs with the mRNA strand you just created.
- Using the chart on the board, identify which amino acid goes with which tRNA base triplet. (Remember to start only at the start codon.)

**If you finish early, check over your work. You may also read quietly while the other groups finish.**

### The Genetic Code

First base	Second base				Third base
	U	C	A	G	
U	UUU Phenylalanine	UCU Serine	UAU Tyrosine	UUU Cysteine	U
	UUC Phenylalanine	UCC Serine	UAC Tyrosine	UUC Cysteine	C
	UUA Leucine	UCA Serine	UAA Stop	UGA Stop	A
C	CUU Leucine	CCU Proline	CAU Histidine	CGU Arginine	U
	CUC Leucine	CCC Proline	CAC Histidine	CGC Arginine	C
	CUA Leucine	CCA Proline	CAG Glutamine	CGA Arginine	A
A	AUU Isoleucine	AUC Isoleucine	AUA Isoleucine	AUG Methionine	M
	AUA Isoleucine	AUA Isoleucine	AUA Isoleucine	AUA Isoleucine	A
	AUG Start/Methionine	AUG Threonine	AAC Asparagine	AAU Asparagine	N
G	GUU Valine	GCU Alanine	GAU Aspartic Acid	GGU Glycine	U
	GUC Valine	GCC Alanine	GAC Aspartic Acid	GGC Glycine	C
	GUA Valine	GCA Alanine	GAA Glutamic Acid	GGA Glycine	A
S	GUU Valine	GCU Alanine	GAU Aspartic Acid	GGU Glycine	U
	GUC Valine	GCC Alanine	GAC Aspartic Acid	GGC Glycine	C
	GUA Valine	GCA Alanine	GAA Glutamic Acid	GGA Glycine	A

Legend:   
     Cysteine   
     Tyrosine   
     Stop   
     Methionine

Copyright © 2004 Pearson Education, Inc.

## Protein Synthesis Video

- ▶ [http://media.pearsoncmg.com/bc/bc\\_0media\\_bio/bioflix/bioflix.htm?c8eproteinsynthesis](http://media.pearsoncmg.com/bc/bc_0media_bio/bioflix/bioflix.htm?c8eproteinsynthesis)

45

## Key

AGA ATG GCT GAA CAG TGA T C G  
(UCU) UAC CGA CUU GUC ACU (AGC)  
(AGA) AUG GCU GAA CAG UGA (UCG)

(Arginine) (Methionine)-(Alanine)-(Glutamic Acid) -  
(Glutamine) (STOP) (Serine)

46

## What if...

AGA ATG GCT GAA CAG TGA T C G

(Arginine) (Methionine)-(Alanine)-(Glutamic Acid) -  
(Glutamine) (STOP) (Serine)

48

## We know that...

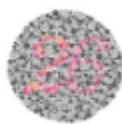
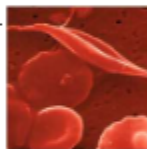
- ▶ Mistakes in DNA replication or protein synthesis are called **MUTATIONS**.



49

## Mutation

- ▶ Certain mutations cause diseases.



52

## Mutation

- ▶ Certain mutations cause diseases.
- ▶ Are these diseases harmful or beneficial?



53

## Cystic Fibrosis

- › What is Cystic Fibrosis?



80

## Cystic Fibrosis

- › What is Cystic Fibrosis?

Cystic Fibrosis is a disease (caused by a mutation) which causes mucus to build up in the lungs and digestive tract.

81

## Cystic Fibrosis

- › Is Cystic Fibrosis harmful? Or can it be beneficial?

Cystic Fibrosis is harmful. People with Cystic Fibrosis generally die young.

82

## Sickle Cell Disease

- › What is Sickle Cell Disease?



Normal red blood cell

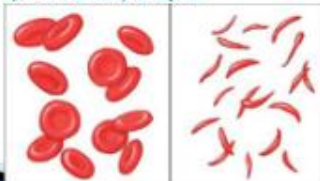
Sickle red blood cell

83

## Sickle Cell Disease

- › What is Sickle Cell Disease?

Sickle Cell Disease is a disease (caused by a mutation) that causes the red blood cells to appear sickle (or crescent) shaped.



84

## Sickle Cell Disease

- › Is Sickle Cell Disease harmful? Or can it be beneficial?

Sickle Cell Disease is harmful. The red blood cells in people with Sickle Cell Disease cannot carry as much oxygen to the bodies tissues as normal red blood cells can. People with Sickle Cell Disease rarely live beyond adolescence.

85

## Heterozygotes

- ▶ What is a heterozygote?

Someone who is a heterozygote has a different copy of each gene from each parent.

40

## Sickle Cell Trait

- ▶ A person who receives the sickle cell gene from one parent, but NOT the other, has Sickle Cell Trait. (This makes them a heterozygote.)

41

## Sickle Cell Trait

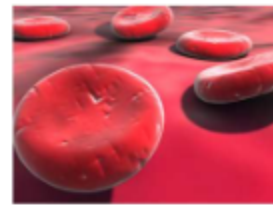
- ▶ A person who receives the sickle cell gene from one parent, but NOT the other, has Sickle Cell Trait. (This makes them a heterozygote.)
- ▶ People who are heterozygous with Sickle Cell have some normal red blood cells, and some sickle-shaped red blood cells.



42

## Sickle Cell Trait

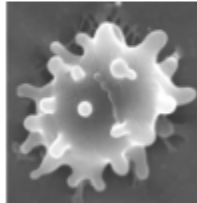
- ▶ Malaria cells hide within red blood cells to multiply. Sickle-shaped cells become deformed when malaria cells try to multiply within them.



43

## Sickle Cell Trait

- ▶ The body's immune system no longer recognizes these deformed sickle-shaped cells, and destroys them along with the malaria cells inside them.



44

## Albinism

- ▶ What is albinism?

Albinism is a genetic disorder where melanin cannot be produced in the body.

45

## Albinism

- Remember: There is a difference between an Albino Tiger and a White Tiger.



47

## Albinism

- Is albinism harmful? Or can it be beneficial?

48

## One Last thing...

- Keep in mind that helpful mutations, despite being rare events, are what generated all of the diversity of life we see on Earth today.

49