DNA to Proteins

Do Now:

1. What are the building blocks of DNA and RNA called?

2. Label the parts of the DNA subunit pictured below – phosphate, sugar, nitrogen base

3. Open your kit and look at the models. Which bases are bigger?

Tips: Answer the questions below as your teacher walks you through helpful hints on how to build DNA and RNA molecules with these models.

- What are the three rules that you should use when building a DNA molecule?

- What is the correct way to “unzip” a DNA helix?

- How can you tell the difference between DNA and RNA nucleotides?
Activity 1: DNA Replication


2. Show your completed DNA molecule to your teacher.
   - Complete the DNA strand below by filling in the complementary strand.
   - Why is DNA called a double helix?

3. After your teacher checks your DNA molecule, replicate your DNA molecule following the instructions on pages 10-13.

4. Show your completed DNA molecules to your teacher.
   - Are your two DNA molecules identical? Yes or No
   - Where did the original strands end up?

5. After your teacher has checked your replicated DNA, carefully take apart the DNA molecules and return the nucleotides to your kit.

✔ DNA Vocabulary Checkpoint – Match the diagrams below with the proper term.

___gene___ – lengths of DNA that contain coded instructions for making proteins

___chromosome___ – long molecules of DNA found in nucleus

___nucleotide___ – building block of DNA/RNA

___codon___ – group of three nucleotides
Activity 2: Transcription

1. Build the DNA gene assigned to you by your teacher on page 20.
   - Write the name of the gene here:

2. Now you are ready to transcribe your gene. Follow the instructions on pages 24-25 to create a molecule of mRNA.

3. Show your mRNA molecule to your teacher.
   - What is transcription? Why do our cells need this process?

   - If you pair the RNA nucleotides with the gene will you get the same sequence as the gene? Why or why not?

   - What are three differences between DNA and RNA?

4. After your teacher has checked your transcribed mRNA, carefully take apart your DNA strands and neatly place the nucleotides back into the kit. Save your mRNA molecule.

Activity 3a: Translation Overview

1. After your teacher has checked your RNA molecule, use the codon chart on pages 26-27 and codon cards you were given to translate your mRNA molecule.

2. Show your amino acid sequence to your teachers.

   - Write your amino acid sequence below.

   - What is translation?

   - Where does translation happen in the cell?

   - Compare your amino acid sequence to another group that had the same gene but different form (mutated or normal). Is your amino acid sequence the same or different?
**Activity 3b: Translation Closeup**

1. Get to know the ribosome. Explore the Ribosome mat that you have been given and use **page 12 of the tRNA Booklet 1** to identify the parts of the ribosome.
   - **Binding Site**: mRNA will bind to the ribosome here
   - **P site**: the first tRNA with its amino acid will bind here
   - **A site**: the next tRNA with its amino acid will bind here
   - **E site**: tRNAs will exit here after adding their amino acids to the protein chain

   - **Label the parts of the ribosome below with the letters B, P, A, or E**

![Ribosome diagram]

2. Load the tRNA molecule that you have been given with the correct amino acid as shown on **page 14**.
   - **What amino acid does your tRNA molecule bind to?**
   - **What is its anticodon?**
   - **What mRNA codon will it bind to?**

3. As a group, complete the translation of the **alpha protein chain**. (Refer to **pages 15-22** for help.)
   - **What part of the tRNA molecule binds to the mRNA molecule?**
   - **What happens to empty tRNA molecules after leaving the ribosome?**
   - **What makes the tRNA with the AUC codon different from other tRNA molecules?**
4. As a group, complete the translation of the **alpha mutated** protein chain. (Refer to pages 15-22 for help.)
   - **Compare the alpha and alpha mutated protein chains. Are there any differences?**

5. Fold the alpha and mutated alpha chains as shown on **page 23**.
   
   ① Tip: Don’t forget to turn all the amino ends so the “eyes” show before you try to fold the chain.
   
   - **Compare the folded alpha and alpha mutated protein chains. Are there any differences in shape?**

6. As a group, complete the translation of the **beta** protein chain. (Refer to pages 24-31 for help.)

7. As a group, complete the translation of the **beta mutated** protein chain. (Refer to pages 24-31 for help.)
   
   - **Compare the beta and beta mutated protein chains. Are there any differences?**

8. Fold the beta and mutated beta chains as shown on **page 32**.
   
   - **Compare the folded beta and beta mutated protein chains. Are there any differences in shape?**

**Exit Ticket:**

- **What does DNA contain the instructions for?**

- **When does a cell need to replicate its DNA?**

- **How do transcription and translation differ?**

- **How can a mutation that changes one nucleotide cause a problem?**