How a Gene Can Affect Your Body

Name _____ Class _____ Date _____

Read the class set and work independently. Write and draw only on this handout. No cutting, folding, or separate models are needed. Use specific evidence in your explanations. Suggested time: 50-60 minutes.

1 Find the instructions

A classmate says, "A gene, DNA, and a chromosome are three separate things." Explain how they are related. What instructions does a protein-coding gene provide?

2 Decode the three sequences

Use the key on class-set page 2 and sequences on page 3. Write the six amino-acid abbreviations in order, then their six charge symbols. Circle any amino acid that differs from the reference.

Reference

Amino acids: _____

Charges: _____

Mutation A

Amino acids: _____

Charges: _____

Mutation B

Amino acids: _____

Charges: _____

Which mutation changes an amino acid? Which changes the DNA but leaves the amino-acid sequence unchanged?

Draw a Possible Shape Change

3 Explain the worked example

In the four-amino-acid example, amino acid 4 changes from negative to positive. Why does this change its interaction with amino acid 1? How could that affect the chain's shape?

4 Draw and revise your own model

a. Reference protein: Draw six connected circles. Number them 1-6 and add the correct charge symbols. Draw a possible arrangement that brings amino acids **1 and 5** near each other. Use a dashed line to show their attraction.

Reference protein drawing

b. Mutation A: Draw the six-amino-acid chain with the changed amino acid. Show one possible arrangement in which amino acids **1 and 5** are farther apart. Keep the circles connected in the same order. Circle the changed amino acid.

Mutation A drawing

These 2D drawings represent possible shapes. Focus on positions 1 and 5; several interactions influence an actual protein's fold.

Explain and Test Your Model

4c Explain the change in your drawing

Explain why you changed the arrangement of the chain. How might a different protein shape affect attachment to a partner molecule?

5 Check your model against evidence

a. Compare the attachment results for the reference and Mutation A. State one result the tests directly show. Include numbers from the table.

b. Explain how your drawing suggests a possible cause of that result. Does the evidence support your prediction about attachment?

c. Identify something the tests did not measure that would help check your explanation.

Connect a Gene Change to a Trait

6 Explain how a tiny change could affect a body

a. Draw a model with labeled arrows linking the **FBN1 gene, fibrillin protein, microfibrils, and connective-tissue function**. Show how a mutation could cause changes along this pathway. Explain each connection with a short arrow label.

Draw your causal model here

b. Explain how a gene change could contribute to a body trait in Marfan syndrome. Use information about fibrillin and microfibrils. Identify one feature of real fibrillin that your charge model leaves out.

7 Does every mutation change a trait

A student claims, "If the DNA changes, the protein's job must change." Evaluate this claim using **Mutation B**. Refer to its DNA sequence, amino-acid sequence, and attachment results. Keep your conclusion focused on the function tested.