



# GeneWorks: DNA to Protein Investigation

Build complementary DNA, transcribe mRNA, translate codons, diagnose molecular case files, and investigate how sequence changes can alter protein outcomes.

**NGSS:** HS-LS3-1 - Clarify relationships between DNA, chromosomes, and instructions for traits. HS-LS3-2 - Use evidence to support claims about mutations as a source of inheritable variation.

Name: \_\_\_\_\_

Class / Period: \_\_\_\_\_

Date: \_\_\_\_\_

## Part A - DNA Structure and Complementary Base Pairing

1. Complete the complementary DNA strand for: 5'- A T G C C A T T G -3'

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2. What base-pairing rule did you use?

\_\_\_\_\_

## Part B - Transcription and Translation

Use the guided GeneWorks stages. Record one model sequence as it moves from DNA to mRNA to amino acids.

| Step                            | Sequence / result |
|---------------------------------|-------------------|
| DNA template or coding sequence |                   |
| mRNA sequence                   |                   |
| Codons                          |                   |
| Amino-acid sequence             |                   |

3. What changes during transcription? What information stays the same?

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4. Why is a codon read as a group of three RNA bases?

\_\_\_\_\_

## Part C - Molecular Case File

Complete one case file in the model. Record the evidence used to identify the molecular problem.

| Case evidence       | Your observation |
|---------------------|------------------|
| DNA / gene evidence |                  |
| mRNA evidence       |                  |
| Protein evidence    |                  |
| Diagnosis           |                  |

## Part D - Mutation Lab

Use the open mutation lab. Test at least three sequence changes. Include at least one substitution and one mutation that changes the reading frame or start/stop behavior if available in the model.

| Mutation trial | DNA change | Protein outcome | Silent / altered / start-stop effect |
|----------------|------------|-----------------|--------------------------------------|
| 1              |            |                 |                                      |
| 2              |            |                 |                                      |
| 3              |            |                 |                                      |

5. Did every DNA change alter the protein? Use one trial as evidence.

6. Explain why a small change in DNA can sometimes produce a large change in a protein, while another change may produce little or no effect.

## Genes, Proteins, and Traits

7. Explain the relationship among a gene, DNA, mRNA, protein, and a trait. Use arrows or a short written model.

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8. A mutation occurs in a body cell but not in cells that produce eggs or sperm. Would you expect that mutation to be inherited by offspring? Explain.

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## Evidence-Based Claim

**Claim:** Mutations are a source of genetic variation, but mutations do not all have the same effect.

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**Evidence and reasoning:** Use two results from your mutation trials to support the claim.

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