Name: _____ **Date:** _____

Section: _____

Epigenetics Activity

Building Proteins: The Cell's Instruction Manual

Phase 1: ENGAGE (5 minutes)

Getting Started: Open peebedu.com and navigate to Epic Genetics

Click '`Tutorial for a quick overview, then Generate DNA`' to create your gene!

The Big Picture: Your DNA is like a recipe book, but it's locked in the nucleus. How do cells read these recipes to make proteins? _____

First Look at Your DNA:

- How many green sections (exons)? _____

- Can you find ATG (start signal)? Where? _____

Think About It: Why might DNA have parts that don't code for proteins (introns)? _____

Phase 2: EXPLORE (20 minutes)

Step-by-Step Protein Production

Part A: Getting Ready to Copy (Transcription)

Add the Green Light:

- Click '`Promoter → Execute`'

- This is like putting a '`START HERE`' sign for the cell!

Make RNA Copies:

- Click '`RNA Polymerase → Execute`'

- Count your RNA transcripts: _____

Power Boost!

- Now try '`RNA Polymerase + Transcription Factor`' together

- Conclusion: Transcription factors _____ RNA production

Part B: Editing the Message (RNA Processing)

Cut Out the Junk:

- Click '`Spliceosome → Execute`'
- Click on a transcript when prompted

- What remains? _____

Try Alternative Editing:

- Use '`Alt Spliceosome`' on another transcript

- Different result? Yes / No

Protect the Message: Add to your spliced RNA:

- 5' Cap - Why? _____

Part C: Making the Protein (Translation)

The Translation Team: Select BOTH tRNA and rRNA → Execute

- Click your protected mRNA

- Number of amino acids: _____

Phase 3: EXPLAIN (15 minutes)

Understanding the Process

The Journey Map: Fill in what happens at each step:

DNA → [_____] → RNA → [_____] → mRNA → [_____] → Protein

Processes: Transcription, Splicing, Translation

The Key Players: Match each tool to its job:

Tool: Job:

- RNA Polymerase • Removes introns
- Spliceosome • Carries amino acids
- tRNA • Reads DNA
- rRNA • Forms ribosome

Pattern Recognition (Find 3):

- Pattern 1: All proteins start with _____ (amino acid)

- Pattern 3: Both caps are needed for _____

The Mutation Game: Click '`Mutagen`' and execute:

- What changed? _____

- Could this affect protein function? _____

Phase 4: ELABORATE (12 minutes)

Real-World Connections

Gene Editing with CRISPR: Click 'CRISPR' and try changing one codon:

- Original: _____

- Result: _____

Why is precise editing important? _____

Alternative Splicing = Multiple Products: From your DNA, create:

- Protein 1 with exons: _____

Real example: One gene can make 38,000 different proteins in your brain!

Disease Connection: If a mutation creates an early STOP codon:

- Normal protein: 100 amino acids
- Mutated protein: 25 amino acids

- Disease example: Muscular dystrophy

Design Challenge:

You're studying a genetic disease. Design an experiment:

- Which tools would you use? _____

- How would you fix it? _____

Phase 5: EVALUATE (8 minutes)

Show What You Know

Sequence the Steps: Number in order (1-7): ___ Add poly-A tail ___ RNA polymerase copies DNA ___ Proteins fold into shape ___ Remove introns ___ Add 5' cap ___ tRNA brings amino acids ___ Promoter signals start

Troubleshooting: Translation isn't working. Check:

- Is mRNA spliced? Yes / No
- Has 5' cap? Yes / No
- Has poly-A tail? Yes / No

Predict the Effect:

A mutation changes UGG (Tryptophan) to UGA (Stop).

- Effect on protein: _____
- Severity: Mild / Moderate / Severe

Big Picture Question: Why do cells go through all these steps instead of making proteins directly from DNA?

Give 2 reasons:

1. _____

Model Review:

- Coolest feature: _____

- One improvement: _____

Quick Reference:

- **Exon:** Coding sequence (EXpressed)
- **Intron:** Non-coding sequence (INTerrupting)
- **Codon:** 3-letter RNA code for one amino acid
- **Start Codon:** AUG (Methionine)
- **Stop Codons:** UAA, UAG, UGA