

Imagine that each word in a sentence is a different gene.

Next to each sentence, write whether the mutation was caused by a **substitution, deletion, insertion or inversion**.

**Original meaning, no mutations: It's raining cats and dogs outside.**

| <b>Mutated sentence</b>                        | <b>Mutation Type (substitution, deletion, insertion, inversion)</b> |
|--|---|
| 1. It's ragning cats and dogs outside.         |   |
| 2. It's raining cats and logs outside.         |   |
| 3. It's raining raining cats and dogs outside. |   |
| 4. It's raining dogs outside.                  |   |
| 5. It's raining edistuo sgod dna stac.         |   |
| 6. It's raining cats anfrogsd dogs outside.    |   |
| 7. It's raining rats and dogs outside.         |   |
| 8. It's raining cats and dogs.                 |   |

Name: \_\_\_\_\_ Date: \_\_\_\_\_ Period: \_\_\_\_\_

### Mutations Worksheet

There are several types of mutation:

**DELETION** (a base is lost)

**INSERTION** (an extra base is inserted)

Deletion and insertion may cause what's called a **FRAMESHIFT**, meaning the reading "frame" changes, changing the amino acid sequence.

**SUBSTITUTION** (one base is substituted for another)

If a substitution *changes* the amino acid, it's called a **MISSENSE** mutation.

If a substitution *does not change* the amino acid, it's called a **SILENT** mutation.

If a substitution *changes the amino acid to a "stop"*, it's called a **NONSENSE** mutation.

→ Complete the boxes below. Classify each as either Deletion, Insertion, or Substitution **AND** as either frameshift, missense, silent or nonsense (hint: deletion or insertion will always be frameshift). See page 367 in text for genetic code

Original DNA Sequence: T A C A C C T T G G C G A C G A C T

mRNA Sequence: \_\_\_\_\_

Amino Acid Sequence: \_\_\_\_\_

Mutated DNA Sequence #1: T A C A T C T T G G C G A C G A C T

What's the mRNA sequence \_\_\_\_\_ (Circle the change)

What will be the amino acid sequence? \_\_\_\_\_

Will there likely be effects? \_\_\_\_\_ What kind of mutation is this? \_\_\_\_\_

Mutated DNA Sequence #2: T A C G A C C T T G G C G A C G A C T

What's the mRNA sequence? \_\_\_\_\_ (Circle the change)

What will be the amino acid sequence? \_\_\_\_\_

Will there likely be effects? \_\_\_\_\_ What kind of mutation is this? \_\_\_\_\_

Mutated DNA Sequence #3: T A C A C C T T A G C G A C G A C T

What's the mRNA sequence? \_\_\_\_\_ (Circle the change)

What will be the amino acid sequence? \_\_\_\_\_

Will there likely be effects? \_\_\_\_\_ What kind of mutation is this? \_\_\_\_\_

Mutated DNA Sequence #4: T A C A C C T T G G C G A C T A C T

What's the mRNA sequence? \_\_\_\_\_ (Circle the change)

What will be the amino acid sequence? \_\_\_\_\_

Will there likely be effects? \_\_\_\_\_ What kind of mutation is this? \_\_\_\_\_

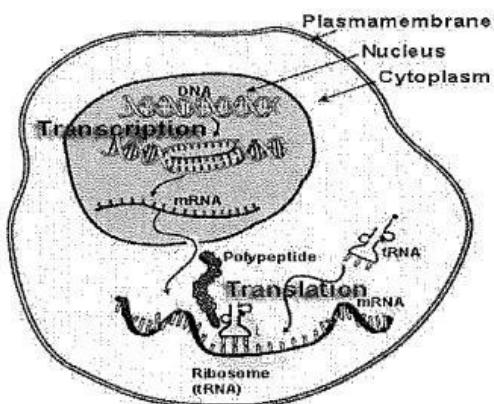
Name \_\_\_\_\_

Date \_\_\_\_\_

Period \_\_\_\_\_

## Nucleic Acids and Protein Synthesis OVERVIEW

|               | DNA | RNA |
|---------------|-----|-----|
| Sugar         |     |     |
| # Strands     |     |     |
| Bases Present |     |     |



|               | ? » ? | Where? |
|---------------|-------|--------|
| Replication   |       |        |
| Transcription |       |        |
| Translation   |       |        |

1. Where (in the cell) does mRNA copy the message from the DNA template?
2. Where does the mRNA go next?
3. The strand below is DNA/RNA  
UUU ACA GGA
4. What is the protein that would result from the sequence in #3?
5. The strand below is DNA/RNA  
ACC GTG CCA
6. What is the protein that would result from the sequence in #5?

## Codon Chart

|            |   | Second base              |                          |                          |     |                          |                     |                          |                            |                  |
|------------|---|--------------------------|--------------------------|--------------------------|-----|--------------------------|---------------------|--------------------------|----------------------------|------------------|
|            |   | U                        | C                        | A                        | G   |                          |                     |                          |                            |                  |
| First base | U | UUU<br>UUC<br>UUA<br>UUG | Phe<br>Ser<br>Leu<br>Leu | UCU<br>UCC<br>UCA<br>UCG | Ser | UAU<br>UAC<br>UAA<br>UAG | Tyr<br>Stop<br>Stop | UGU<br>UGC<br>UGA<br>UGG | Cys<br>Stop<br>Stop<br>Trp | U<br>C<br>A<br>G |
|            | C | CUU<br>CUC<br>CUA<br>CUG | Leu                      | CCU<br>CCC<br>CCA<br>CCG | Pro | CAU<br>CAC<br>CAA<br>CAG | His<br>Gln          | CGU<br>CGC<br>CGA<br>CGG | Arg                        | U<br>C<br>A<br>G |
|            | A | AUU<br>AUC<br>AUA<br>AUG | Ile                      | ACU<br>ACC<br>ACA<br>ACG | Thr | AAU<br>AAC<br>AAA<br>AAG | Asn<br>Asp          | AGU<br>AGC<br>AGA<br>AGG | Ser<br>Arg                 | U<br>C<br>A<br>G |
|            | G | GUU<br>GUC<br>GUA<br>GUG | Val                      | GCU<br>GCC<br>GCA<br>GCG | Ala | GAU<br>GAC<br>GAA<br>GAG | Asp<br>Glu          | GGU<br>GGC<br>GGA<br>GGG | Gly                        | U<br>C<br>A<br>G |
|            |   |                          |                          |                          |     |                          |                     |                          |                            | Third base       |

Ala = alanine

Gln = glutamine

Leu = leucine

Ser = serine

Arg = arginine

Glu = Glutamate

Lys = lysine

Thr = threonine

Asn = asparagine

Gly = glycine

Met = methionine

Trp = tryptophan

Asp = aspartate

His = histidine

Phe = phenylalanine

Tyr = tyrosine

Cys = cysteine

Ile = isoleucine

Pro = praline

Val = valine