

# Explore: Mutations - Superhero Edition



INSTRUCTOR:

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## Objective:

- Learn about different types of mutations: substitution, insertion, and deletion.
- Understand how these mutations can change proteins in the body.
- Practice writing the mRNA code and translating it into proteins.



## Types of Point Mutations:

1. **Substitution Mutation:**
  - **Description:** One base in the DNA sequence is replaced with a different base.
  - **Example:** Changing A to T.
  - **Effect:** Can create a new protein or change the protein's function.
2. **Insertion Mutation:**
  - **Description:** Adding one or more extra bases into the DNA sequence.
  - **Example:** Adding A between two base pairs.
  - **Effect:** Often causes a big change in the protein because it shifts everything out of place.
3. **Deletion Mutation:**
  - **Description:** Removing one or more bases from the DNA sequence.
  - **Example:** Removing G from the sequence.
  - **Effect:** Can change the whole protein by shifting the sequence.

## Types of Mutations in Proteins:

- **Missense Mutation:** Changes one amino acid in the protein, which can change how the protein works.
- **Nonsense Mutation:** Creates a stop signal too early, making the protein shorter and often nonfunctional.
- **Silent Mutation:** Does not change the amino acid sequence of the protein, so it usually has no effect.

## Story Time:

In the lively city of Lumina, superheroes were always ready to save the day. One sunny day, the heroes faced an exciting challenge.

Solar Flare was zooming through the sky, feeling the sun's energy power his incredible blasts. Down below, Aqua Surge was at the beach, making waves and creating powerful water shields. Shadow Striker was moving quietly, using his invisibility to keep an eye on everything from the shadows.

Suddenly, the city was plunged into chaos. Nightshade, the villain who could create scary illusions, started making everyone see frightening things. People were terrified and didn't know what was real.

Solar Flare spotted the trouble from above and quickly flew down to help. Aqua Surge felt the fear in the water and rushed to the city center to protect people with her water powers. Shadow Striker knew it was time to act and used his stealth to sneak up on Nightshade.

Together, the heroes made a plan. Solar Flare used his energy blasts to clear the dark mist. Aqua Surge used her water to push back the illusions. Shadow Striker created a shadow barrier around Nightshade, making it harder for him to make new illusions.

With teamwork and bravery, the heroes stopped Nightshade and saved the city. People cheered and celebrated their heroes.

"We did it!" Solar Flare said with a smile.

Aqua Surge nodded, "Working together makes us stronger."

Shadow Striker agreed, "It's great to have friends who help each other out."

As Nightshade was taken away, Lumina was peaceful once again, thanks to the amazing teamwork of its superheroes.

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### Case Study Backstory:

In the city of Lumina, where superheroes and villains are always up to something exciting, four incredible characters were about to have a big adventure:

- 1. Solar Flare** could shoot powerful energy blasts from his hands. His DNA allowed him to turn sunlight into this amazing power.
- 2. Aqua Surge** could control water and create big waves or calm shields. Her DNA had a special change that helped her control water in amazing ways.
- 3. Shadow Striker** could become invisible and blend into shadows. Her DNA gave her the ability to hide and move quietly, making her an expert at staying unseen.

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

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

But not all mutations were good. **Nightshade**, the villain, used his powers to make people see scary things. His twisted DNA let him create terrifying illusions that made everyone in the city feel afraid.

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**Original DNA Sequence:**

**5'-ATG CTG ACG TTA GCC TAG GTC AGT ACG ATG CGT A-3'**

**mRNA Sequence: (T-A, A-U, C-G)**

\_\_\_\_\_

**Amino Acid Sequence**

\_\_\_\_\_

\_\_\_\_\_

**Mutations to Analyze:**

**1. Substitution Mutation: Solar Flare**

- **Mutation Description:** Change the 10th base pair from T to C.

**Original Sequence:**

**5'-ATG CTG ACG TTA GCC TAG GTC  
AGT ACG ATG CGT A-3'**



**Mutated Sequence:**

\_\_\_\_\_

**mRNA Sequence: (T-A, A-U, C-G)**

\_\_\_\_\_

**Amino Acid Sequence**

\_\_\_\_\_

**2. Deletion Mutation: Shadow Striker**

- **Mutation Description:** Delete the 15th base pair, which is C.

**Original Sequence:**

**5'-ATG CTG ACG TTA GCC TAG GTC**  
**AGT ACG ATG CGT A-3'**

**Mutated Sequence:**

\_\_\_\_\_

**mRNA Sequence: (T-A, A-U, C-G)**

\_\_\_\_\_

**Amino Acid Sequence**

\_\_\_\_\_

**3. \_\_\_\_\_ Mutation: Aqua Surge**

- **Mutation Description:** Insert A between the 20th and 21st base pairs.

**Original Sequence:**

**5'-ATG CTG ACG TTA GCC TAG GTC AGT**  
**ACG ATG CGT A-3'**



**Mutated Sequence:**

\_\_\_\_\_

**mRNA Sequence: (T-A, A-U, C-G)**

\_\_\_\_\_

**Amino Acid Sequence**

\_\_\_\_\_

4. \_\_\_\_\_ **Mutation: NightShade**

- **Mutation Description:** Change the 15th base pair C to an A

**Original Sequence:**

**5'-ATG CTG ACG TTA GCC TAG GTC**

**AGT ACG ATG CGT A-3'**

**Mutated Sequence:**

\_\_\_\_\_

\_\_\_\_\_

**mRNA Sequence: (T-A, A-U, C-G)**

\_\_\_\_\_

**Amino Acid Sequence**

\_\_\_\_\_



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

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

### Create Your Own!

Mutation Type: \_\_\_\_\_

Hero / Villain Name: \_\_\_\_\_

Original Sequence:

**5'-ATG CTG ACG TTA GCC TAG GTC AGT ACG ATG CGT A-3'**

Mutated Sequence:

\_\_\_\_\_

mRNA Sequence: (T-A, A-U, C-G)

\_\_\_\_\_

Amino Acid Sequence

\_\_\_\_\_

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

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

