

Activity – Gene Mutation

Subject	Biology
Class	XII
Chapter	Molecular Basis of Inheritance
Topic	Mutation
Duration	2 periods
Nature of the Activity	Individual

What will I learn? (Learning Outcome) –understand the mechanism of Gene Mutation, classify the kinds of gene mutations under- insertion, deletion, substitution, frame-shift mutation

Skills- Observing, Identifying, Classifying

What I have to do? –To perform an activity to demonstrate the kinds of point mutation

What do I require?

- building blocks on which different alphabets are written
- paper strips on which- A,T,G,C are written
- glue

What do I need to know?

DNA replication, Transcription, Translation, Universal Genetic code, Central dogma of Molecular Biology

- **Teacher's activity-** Teacher will give the instructions along with the protocol (Student's activity)
- Teacher will tell students to make a sentence having three alphabets in each word, like- Tim got red car. To proceed as per instructions, always keeping the reading frame such that only three letters were to be read together

How will I proceed?

- **Student's activity**
 1. To make a sentence like- TOM HAS ONE BAT, using the blocks
 2. Remove a block, say 'M' and read the sentence such that only three letters are read together

3. Add a block, say 'C' after 'M' and read the sentence such that only three letters are read together
4. Replace block 'M' with 'Y' and read the sentence
5. See if the sentences framed in steps 2, 3, 4, make sense
6. Paste several strips of A,T,G,C on the blocks and make a model of a DNA fragment with sequence 5' AATCGGCATCGG 3'
7. Write the complimentary DNA strand, write the mRNA formed and the oligopeptide (using genetic code)
8. Similarly, remove the 3rd base from the model, write the complimentary DNA strand, write the mRNA formed and the oligopeptide (using genetic code)
9. Add 'T' after the 3rd base, write the complimentary DNA strand, write the mRNA formed and the oligopeptide (using genetic code)
10. Replace C on 4th place with T, write the complimentary DNA strand, write the mRNA formed and the oligopeptide (using genetic code)
11. Write the sequence of all the segments- DNA, mRNA, and the oligopeptide.
12. Compare your answers in step 7, with those in steps 8, 9,10

What have I observed?

Correct Sentence	TOM HAS ONE BAT
Sentence after removal of an alphabet (Step 2)	
Sentence after addition of an alphabet(Step 3)	
Sentence after replacement of an alphabet (Step 4)	
Correct Sequence	5' AATCGGCATCGG 3'
Complementary Sequence of the DNA after removal of a base (Step 8)	-----
Complementary Sequence of the DNA after addition of a base (Step 9)	-----
Complementary Sequence of the DNA after replacement of a base (Step 10)	-----
Sequence of the mRNA (in 5' to 3' direction) after removal of a base	----- Call it [I]

Sequence of the mRNA (in 5' to 3' direction) after addition of a base	----- Call it [II]
Sequence of the RNA (in 5' to 3' direction) after replacement of a base	----- Call it [III]
Oligopeptide formed from [I] {Refer to Genetic code given in Biology text book (Class XII) -Table 6.1}	
Oligopeptide formed from [II] (Refer Genetic code given in text book -Table 6.1)	
Oligopeptide formed from [III] (Refer Genetic code given in text book -Table 6.1)	

Even a single gene mutation can lead to formation of an altered complimentary strand of DNA, an altered mRNA and addition of altered amino acids in the peptide chain, resulting in a truncated protein and thus abnormal phenotype/ functioning of the cell/ organism.

What have I learnt?

Addition/ deletion, can lead to frame shift mutation leading to formation of a different mRNA (after the point mutation), resulting in different amino acids hence leading to formation of a totally altered protein. Substitution could finally lead to replacement of correct amino acid with a different (altered) amino acid, hence forming an altered protein, leading to diseases like Sickle Cell Anaemia.

What would I like to know ?

What is Wobble hypothesis? What are silent mutations?

Let me Evaluate myself-

1. What is another term for point mutation?
2. List the points that you will include in the definition of 'Mutation.'
3. Explain how sickle cell anaemia is caused, from the point of central dogma of molecular biology.
4. If the sequence on mRNA strand is 5' AUGUCCUGAACUAA 3'

What will be the anticodons ? How many amino acids will be there in the oligopeptide formed from this RNA?

5. For the oligopeptide- Met – Arg – Ile – Gly

Write the codons. Compare your answers with your classmates. Some students may have different answers, still they are marked correct by the teacher. Why?