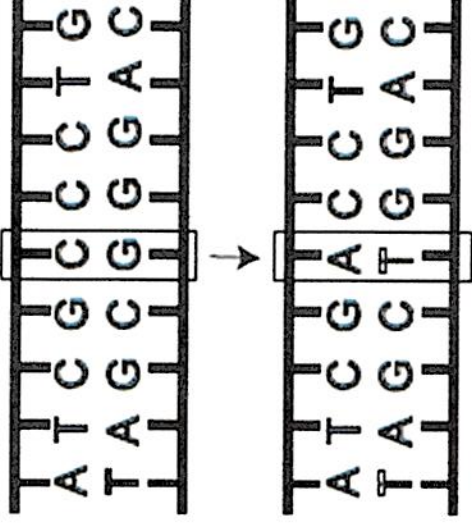


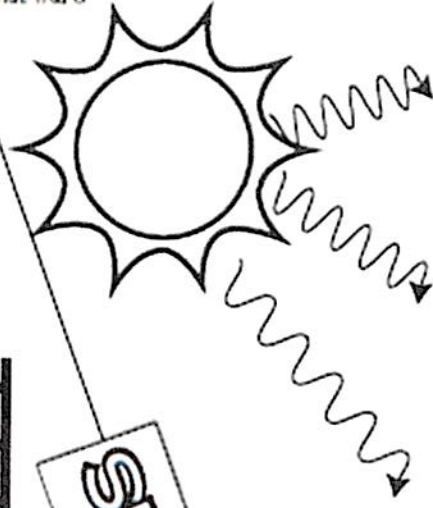
## Mutations are changes in the DNA code

- Mutations can be \_\_\_\_\_ or \_\_\_\_\_.
- Some mutations change only one \_\_\_\_\_.
- Some mutations are really large. When a large portion of different DNA is \_\_\_\_\_ into the middle of a gene or even in the \_\_\_\_\_ of a gene, the gene sequence can be changed.
- Some mutations can happen during \_\_\_\_\_ and recombination.
- Mutations can be caused by \_\_\_\_\_ by DNA Polymerase when it is trying to \_\_\_\_\_ DNA or \_\_\_\_\_ DNA.



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

0123456789



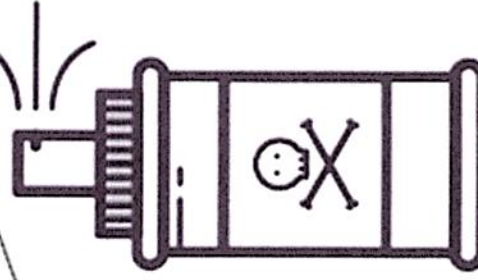
# Mutations and Mutagens

OOPS!!!

DNA Polymerase

Mutagens are substances or phenomena that can cause DNA mutations

- \_\_\_\_\_ and \_\_\_\_\_ can cause DNA nucleotides next to each other to react and change their shape slightly.
- When \_\_\_\_\_ copies that section of the DNA, it can make a mistake.
- Some chemicals can "stick" to DNA or interfere with DNA Replication: examples: \_\_\_\_\_
- Some \_\_\_\_\_ can cause DNA damage by inserting their own DNA into the cell's DNA. This can cause \_\_\_\_\_ or \_\_\_\_\_ in the middle of important genes.



**Gene Mutations:** involve changes in \_\_\_\_\_ or a few \_\_\_\_\_ so are often called **point mutations** as they occur at a single \_\_\_\_\_ on the \_\_\_\_\_ sequence. Gene mutations include:

1. \_\_\_\_\_ where one \_\_\_\_\_ is changed to another often only affecting a single \_\_\_\_\_ acid.

**Protein without mutation**

Wildtype Allele for Gene Bio57

Example #1: \_\_\_\_\_ Mutation

3' TACGGAGCAAGCCCAAT 5'  
 5' ATGCCTCGTCGGGGTAA 3'

mRNA  
 AUGCCUCGUUCGGGGUAA

Protein Bio57  
 (Met) (Pro) (Arg) (Ser) (Gly)

example 1, the mutation is called a \_\_\_\_\_ mutation, because its acts are not seen. ten the \_\_\_\_\_ nucleotide in a codon does not matter, the amino acid for CGG GU codons is the same (Arginine). is called the \_\_\_\_\_

A Mutation Allele for Gene Bio57

Example #2: \_\_\_\_\_ Mutation

3' TACGGAGCAAGCCCAAT 5'  
 5' ATGCCTCGTCGGGGTAA 3'

mRNA  
 AUGCCUCGUUCGGGGUAA

Possibly Functional Protein Bio57  
 (Met) (Ala) (Arg) (Ser) (Gly)

A Mutation Allele for Gene Bio57

Example #3: Nonsense Mutation

3' TACGGAGCAATCCCCATT 5'  
 5' ATGCCTCGTCGGGGTAA 3'

mRNA  
 AUGCCUCGUUAGGGGUAA

Shortened, not functional protein  
 (Met) (Pro) (Arg)

• In example 2, the mutation is called a \_\_\_\_\_ mutation, because one \_\_\_\_\_ is changed because of the base change.  
 • This may or may not have an effect on the protein function.

• In example 3, the mutation is called a \_\_\_\_\_ mutation, because one codon has been changed to a \_\_\_\_\_ codon.  
 • This often results in \_\_\_\_\_ being produced.

A Mutation Allele for Gene Bio57

Example #4: Deletion of \_\_\_\_\_ base

3' TACGGAGCAAGCCCAAT 5'  
 5' ATGCCTCGTCGGGGTAA 3'

mRNA  
 AUGCCUCGUUCGGGGUAA

Abnormal Protein Bio57  
 (Met) (Leu) (Val) (Arg) (Gly) .....


• In example 4, the mutation is called a \_\_\_\_\_  
 • When \_\_\_\_\_ base is added or deleted, it "throws off" the whole rest of the protein. In the example above, after the base deletion, the sequence becomes \_\_\_\_\_ from the original.

\_\_\_\_\_ and \_\_\_\_\_ are when a base is added or removed from the DNA sequence causing the \_\_\_\_\_ of the \_\_\_\_\_ to \_\_\_\_\_ for every codon that follows, because of this they are also known as \_\_\_\_\_ **mutations** because they shift the "reading frame". This \_\_\_\_\_ could change \_\_\_\_\_ amino acid that follows altering a \_\_\_\_\_ to the point it is unable to perform its \_\_\_\_\_ function.




# Chromosomal Mutations:

involve changes in the \_\_\_\_\_ or \_\_\_\_\_ of chromosomes. These mutations change the \_\_\_\_\_ of genes on chromosomes and may even change the number of \_\_\_\_\_ of some genes. There are 4 types of chromosomal mutations: deletions, duplications, inversions and translocations.




Original chromosome

produce \_\_\_\_\_ - reverse the \_\_\_\_\_ of \_\_\_\_\_ of chromosomes.




Inversion

\_\_\_\_\_ occur when \_\_\_\_\_ of \_\_\_\_\_ chromosome \_\_\_\_\_ off and \_\_\_\_\_ to \_\_\_\_\_.




Translocation

\_\_\_\_\_ involve the loss of \_\_\_\_\_ or \_\_\_\_\_ of a chromosome.



Deletion

\_\_\_\_\_ produce \_\_\_\_\_ copies of \_\_\_\_\_ of chromosomes.



Duplication

# Significance of Mutations:

Most mutations are \_\_\_\_\_, meaning they have little to no effect on the organism; however mutations that cause dramatic changes in protein \_\_\_\_\_ or gene \_\_\_\_\_ are often \_\_\_\_\_, producing \_\_\_\_\_ proteins that disrupt normal biological activities and may result in genetic \_\_\_\_\_. Some genetic disorders include cystic fibrosis, sickle cell anemia, Tay-Sachs disease, phenylketonuria (PKU) and colour blindness among many others. The other side is that some are \_\_\_\_\_ that may produce proteins with \_\_\_\_\_ or \_\_\_\_\_ activities that can be useful to organisms in different or changing \_\_\_\_\_, this can cause \_\_\_\_\_.