TYPES OF MUTATIONS = change in the genetic code  
Can be due to :  
  
 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

|  |  |  |
| --- | --- | --- |
| Substitution |  | One letter is replaced by a different letter |
| deletion |  | Piece of DNA is deleted and lost |
|  |  | Piece of DNA is added |
| insertion |  | Extra copies of a section of DNA are  Added |

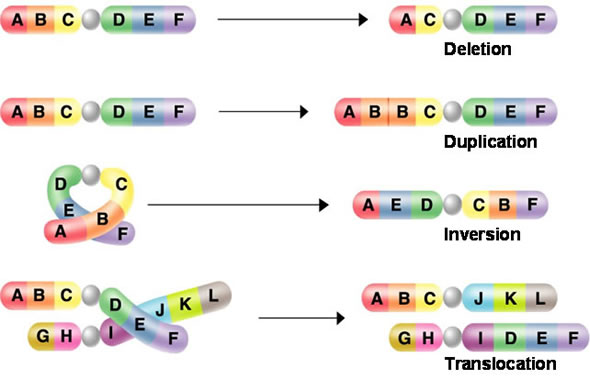
GENE MUTATIONS= change in a single gene  
  
\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_- Change in just a few nucleotides in DNA sequence

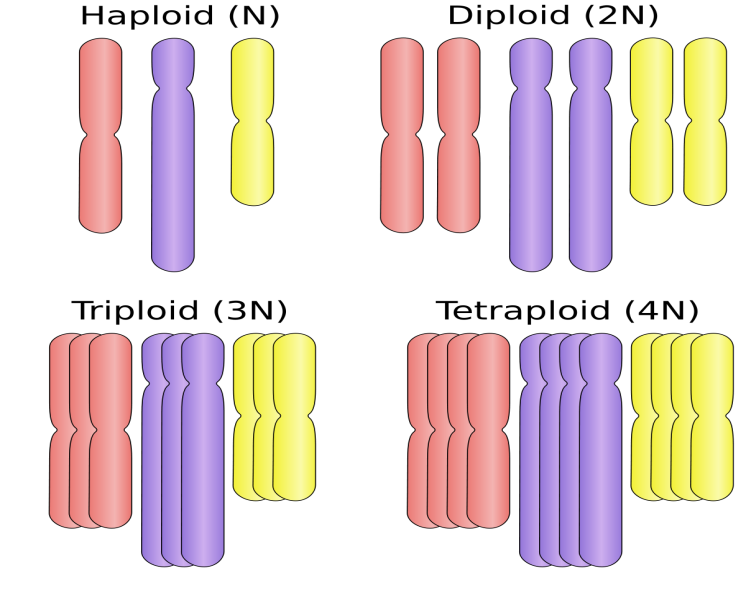
If change codes for same amino acid = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ mutation  
 GGC and GGA BOTH code for glycine = ”WOBBLE”

If change codes for a different amino acid = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ mutation  
 May change function of protein   
 EX: Sickle cell mutation: A → T   
  
 If change codes for a STOP instead of an amino acid = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ mutation  
 Protein sequence will be terminated early (shorter) and NONFUNCTIONAL.

frameshift  
  
  
Because messages are read in groups of 3 letters (CODON)   
 insertions/deletions can cause a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

A shift in the reading frame changes every codon after the mutation.  
Can result in NONSENSE or MISSENSE mutations.  
Frameshift mutations at beginning of a gene change more of the code than at the end.

CHROMOSOMAL MUTATIONS –changes in number or structure of chromosomes

   
   
\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  
  
LETHAL in mammals  
rare in most animals  
   
 Beneficial in plants