**Chapter 25 Review #3 KEY**

**Learning Outcome E-3**

1. **They occur on their own just by accident, there was no mutagenic agent (like radiation, chemicals etc) responsible for the mistake.**
2. **A mutagen is any environmental factor that causes a mutation.**

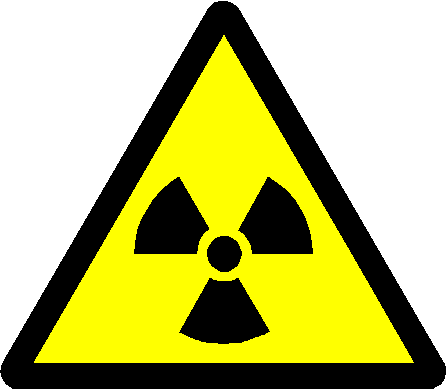
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1. **CARCINOGEN**
2. **Environmental Mutagens are : A) Chemical or B) ENERGY - Radiation**
3. **Four Chemical Mutagens would include: Herbicides, Pesticides, Heavy Metals, Drugs, Food additives and some other Toxins.**
4. **Suspected mutagens are tested on bacteria 🡪 simple animals (insects) 🡪 simple mammals 🡪 primates.**
5. **Radiation is so dangerous because it is invisible.**

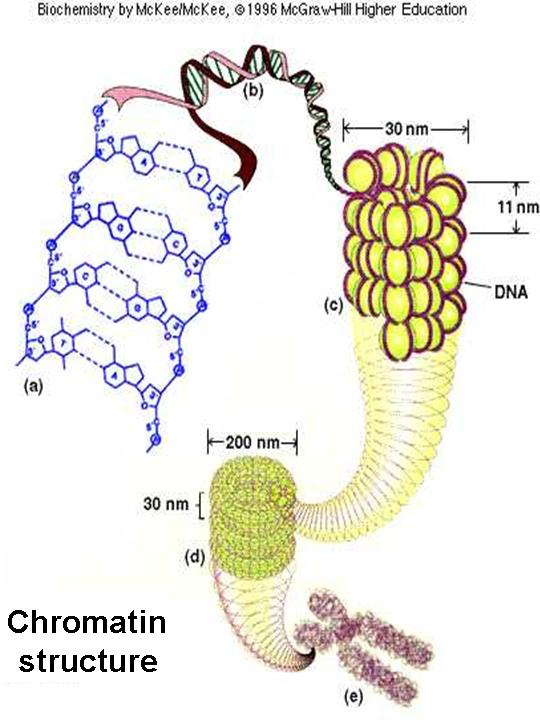


1. **Some examples of radiation mutagens are : most very short wavelengths, Gamma Rays, X-Rays, Ultra-Violet Rays.**

**X-Ray tech with Lead Apron on.**

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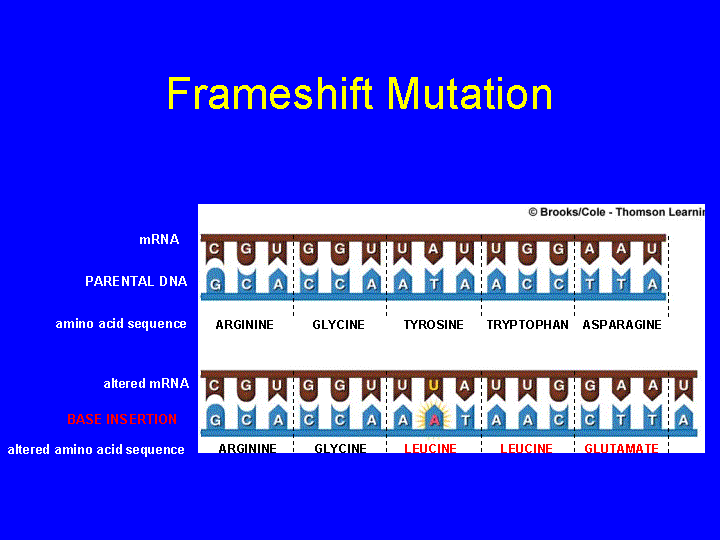
**LO – E-4**

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1. **Gene mutations are mutations that affect one gene. A chromosomal mutation affects a portion of chromosome, therefore many genes are affected during a chromosomal mutation.**
2. **A “FRAMESHIFT” gene mutation requires that a base has been deleted or added into the gene. This causes all codons beyond that point to be re-arranged.**
3. **A) “FRAMESHIFT – Addition” gene mutation. Ex Insert “T”**

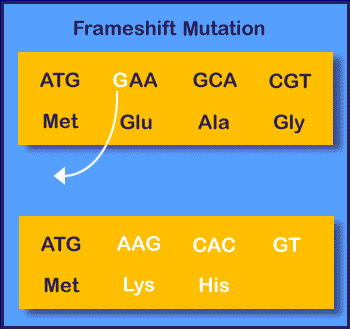
**THE CAT ATE THE RAT**

**THE TCA TAT ETH ERA T**

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**B) A "Frameshift Deletion" gene mutation  
  
THE CAT ATE THE RAT**

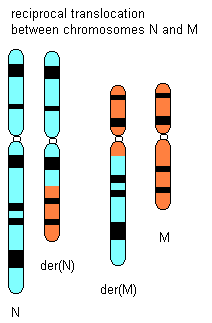
**THE ATA TET HER AT**

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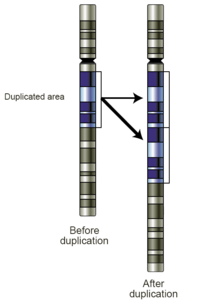
1. **When a single base is substituted for another we classify it as a “POINT” substitution gene mutation.**
2. **May be SILENT – if codon still gives proper AA.**
3. **May be MIS-SENSE – if new codon gives rise to wrong AA, but protein is built fairly close to normal.**
4. **May be NONSENSE – If new codon is a stop codon. Translation is terminated.**
5. **Chromosomal mutations are more serious as many genes are affected.**



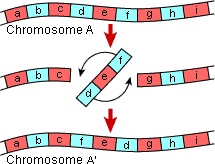
1. **When one part of one chromosome breaks off and relocates to a NON-HOMOLOGOUS chromosome we classify this as “TRANSLOCATION”**

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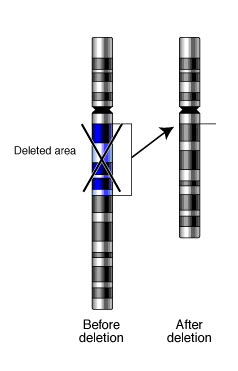
1. **When two sets of genes are found on one Chromosome, it is classified as a DUPLICATION Chromosomal Mutation.**



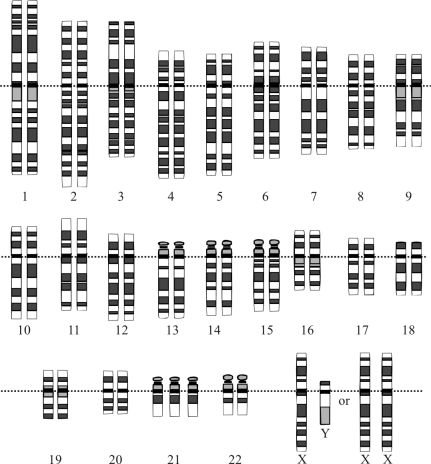
1. **INVERSION chromosomal mutation.**

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1. **DELETION chromosomal mutation.**

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1. **A somatic mutation is one that occurs to a normal BODY cell. These can be fairly harmful if they take place during early embryonic development, or as an infant.**
2. **A germinal mutation is one that occurs during Meiosis to a germ(sex) cell. Ex to an egg or a sperm. Very detrimental if the mutant sex cell is used to create the zygote (first cell in conception).**
3. **There are two causes to Down Syndrome, the majority of DS is caused by non-disjunction of the 21st pair of chromosomes during meiosis. But about 5% of DS is caused by a Translocation on the 21st chromosome.**

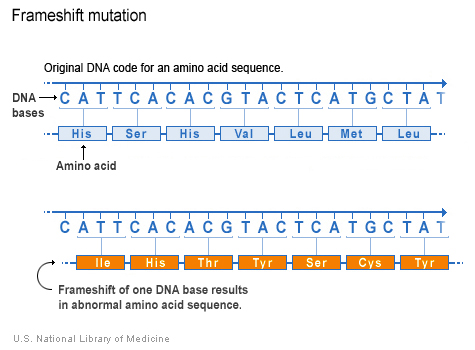
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**The karyotype (chromosome set) above shows that there is an extra chromosome #21, as the pair of 21 in the cell did not separate into different sex cells.**

1. **Hemophilia is usually a germinal mutation of a chromosome or gene that originally occurred to a Germ Cell. Lack a specific clotting factor.**

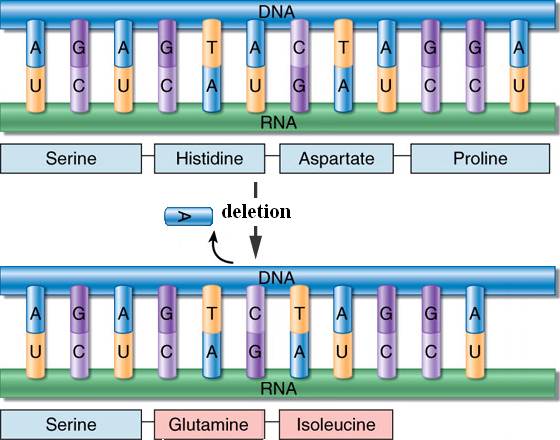
Identify each type of mutation illustrated below: Be as specific as possible

**1.**



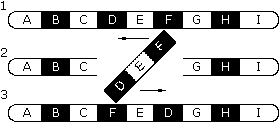
1. **FRAMESHIFT deletion** as the sequence still looks the same but the reading of the codons is shifted. Example CAT TCA above is now ATT CAC in the mutated version

**2.**



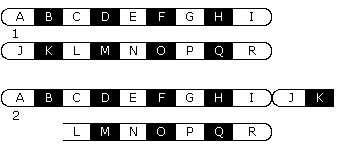
2. **FRAMESHIFT deletion** as well, all codons past the deleted Adenine, will be affected as is seen here

**3.**



**3.Chromosomal Inversion.** Sequence D-E-F is spliced in as F-E-D. It is inserted upside-down.

**4.**



**4. Chromosomal Translocation:** ABCDEFGHI chromosome should not crossover with JKLMNOPQR chromosome, as they are non-homologous