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Mutagens

Recall that chromosomes are made up of strands of DNA. DNA is a very stable organic molecule. During the lifetime of an organism, its DNA is duplicated millions of times. Most of the time, duplication occurs accurately and the new DNA molecule is identical to the original strand. Occasionally, though, a mistake occurs and the DNA molecule is changed. How do these changes affect the organism?

Geneticists estimate than an error in copying the genetic material occurs between 1 in 1000 and 1 in 100,000 replications. A mutation is a permanent change in the genetic material of a cell. Thus the rate of mutation for any one gene is low. For a whole population, however, the rate of mutation is relatively high. It is estimated that each new person born will probably carry two gene mutations. Mutations provide the variations that are the basis of changes in a population and, eventually, a species.

Mutations are often caused by mutagens. A mutagen is a substance or condition that causes or increases the rate of mutation. Some viruses and very high temperatures are mutagens. Other mutagens include chemicals such as industrial chemicals, pesticides, cigarette smoke, and some food additives.

Radiation is a well known mutagen. X-rays and gamma rays contain large amounts of energy. The energy from these forms of radiation is strong enough to damage DNA, resulting in bone marrow cancers and leukemia. Large amounts of ultraviolet light from the sun cause premature aging of the skin and an increase in the number of skin cancers.

(1) What is a mutation? _____

_____

(2) What is a mutagen? _____

_____

(3) List at least three mutagens.

_____

_____

(4) Why does a dentist leave the room when he or she takes an X-ray of your teeth?

_____

_____

(5) The ozone layer surrounding Earth helps protect humans and other organisms from the sun's ultraviolet rays. What is the significance of a depleted ozone layer and of these ultraviolet rays?

_____

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Gene Mutations

{Textbook page 307}

Genes can be mutated by either deleting or inserting a base (frameshift mutation), or by changing a base from one to another (point mutation).

Describe the mutated genes below as either:

A) Base Deletion – Frameshift
B) Base Insertion – Frameshift
C) Point Mutation

1. TCG TAA CGT A (Mutation →) TCT AAC GTA _____

2. CGA TTC AA (Mutation →) CGA GTT CAA _____

3. CGA TCC GA (Mutation →) CGT TCC GA _____

4. CCC GTA GGG A (Mutation →) CCC GTT AGG GA _____

5. TTT ATC CGA AA (Mutation →) TTT ACC CGA AA _____

6. ACC GCC ACT CGT (Mutation →) CCG CCA CTC GT _____

7. AGC CAA AGG CTA (Mutation →) AGC CAA AGG CCA _____

8. AAA CGT GTA AA (Mutation →) AAA CGT GTA TAA _____

9. GTA TTT ACA CTC (Mutation →) GTA TTT ACA CC _____

10. GGG ATT TAG CAT (Mutation →) GGG GAT TTA GCA T _____

11. Which type of gene mutation results in the least change in the sequence of nitrogen bases?

_____ Why? _____

_____

12. Which type of gene mutation results in the most change in the sequence of nitrogen bases?

_____ Why? _____

_____