Chapter 3: Genetic Variation and Polymorphism

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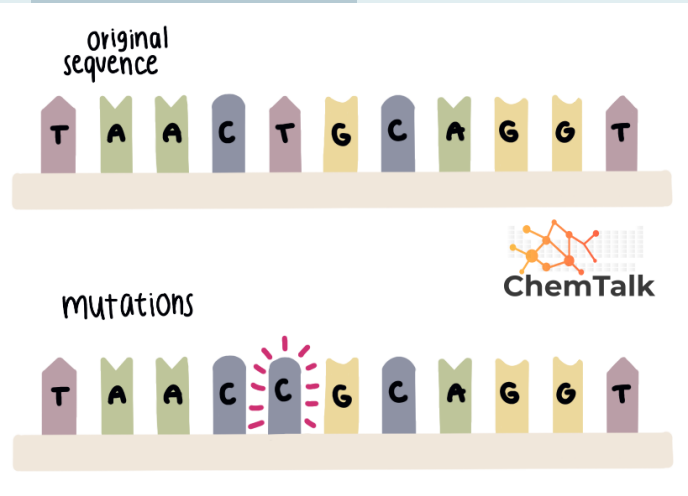
Document 1

Mutations and the Environment

- Mutation: is a change in the nucleotide sequence of DNA. It is spontaneous but it can be induced experimentally.

- Are mutations favorable or harmful?
- Are they inherited?
- What is the influence of the environment on the genome?



I. Mutations and Genetic Variation

* Paragraph + Doc.a p.58:

1 Mutations and genetic variation

A mutation is a spontaneous event capable of producing new phenotypes from an already existing one. Changes in environmental conditions of a population may favor one phenotype over another, thus rendering it better adapted to its new environment.

One of the best examples is that of the *Biston betularia,* the English peppered moth. Prior to the industrial revolution in England, the trunks of trees were lightly colored. The peppered moths, which were also lightly-colored, blended well with these trunks and escaped their predators.

The phenotype light-color of the moths had a higher frequency than that of the dark color, which was initially produced by mutation.

During the industrial revolution, tree trunks were blackened by pollution. The dark-colored moths were better camouflaged from predators. So their number increased in the population while the number of light-moths declined over the years.

Doc.a *Mutation of moths.*

- Specify whether mutations are always harmful.

Mutations are not always harmful, like in the case of peppered moth. A gene mutation produced a generation of dark-colored moths. This helped moths to overcome the environmental changes after the industrial revolution.

II. Transmission of Mutations

- Only mutations in a germ-line cell can be transmitted to the offsprings. The resulting offspring will have this mutation in all somatic and germ cells, and are thus hereditary.

  example: mutation in the B-globin gene that causes B thalassemia (hereditary anemia)

- Mutations in somatic cells are not transmitted to the offsprings, and thus are not hereditary.

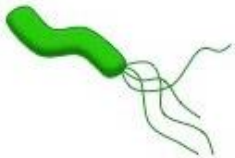
- **Causes of mutations in somatic cells:**

- Errors in DNA replication.
- Environmental factors (mutagenic agents). example: smoking, prolonged exposure to UV-B rays (sun's ultraviolet radiations) , pollutants…

- Some of these mutations in somatic cells in a number of genes can cause cancer in different organs (lungs, lips, tongue, skin..)

- The cell has a DNA repair system that corrects most of these mutations.
- Mutations may affect the genes responsible for DNA repair mechanisms or those regulating cell growth, which causes skin cancer. Only daughter cells of tumor mother cell inherit this genetic mutation. Since genome of the gametes is not affected, this mutation is not transmitted to the offsprings , Doc.b p.59.
- Ozone depletion may increase the exposure to UV- B rays which causes mutations and increase the incidence of cancer (skin cancer).

Mutagenic agents: factors that cause mutation

Radiation		Chemicals			Infectious Agents	
						
UV *(from sunlight)*	X-rays *(medical uses)*	Carcinogens *(e.g. cigarettes)*	Processed foods & preservatives	Cosmetics & cleaning products	Viruses *(e.g. HPV)*	Bacteria (e.g. *Helicobacter*)