

BIOLOGY – October 17 - 2022

NUCLEUS
AND CELL DIVISION

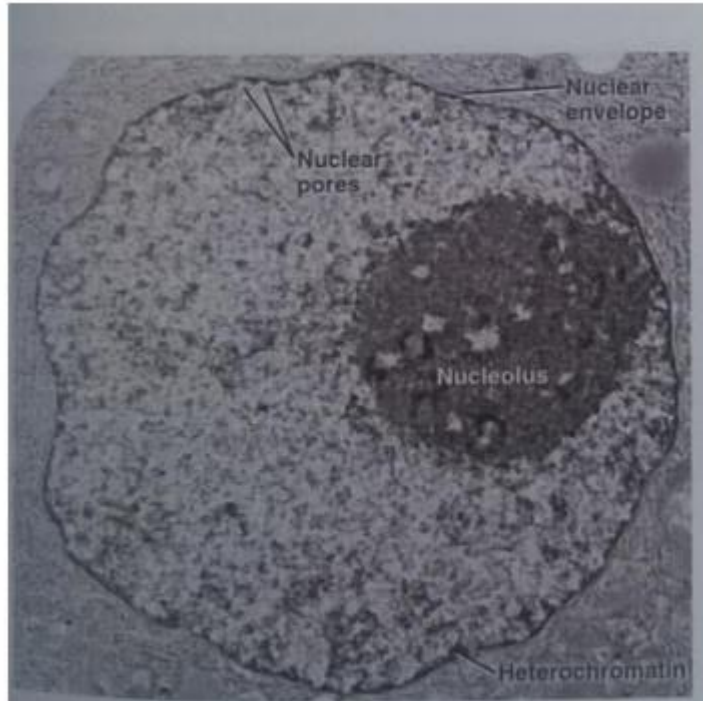


FIGURE 9.1 ELECTRON MICROGRAPH OF A THIN SECTION OF A CANCER CELL NUCLEUS WITH MAJOR FEATURES LABELED. (Courtesy Scott Kaufmann, Mayo Clinic, Rochester, MN.)

- DNA chains in nucleus are not like single molecules of water in cup. DNA in nucleus is divided into several „macro-molecules“ which are connected with **protein scaffolds**
- **this components create:**

„DNA+protein“ = **CHROMOSOMES**

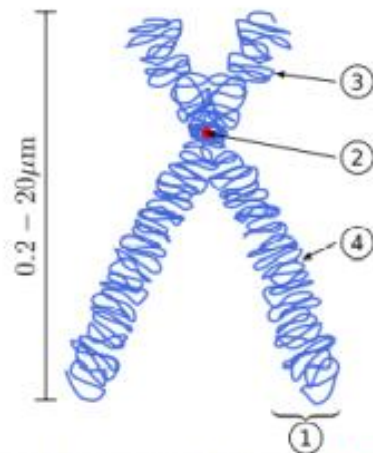
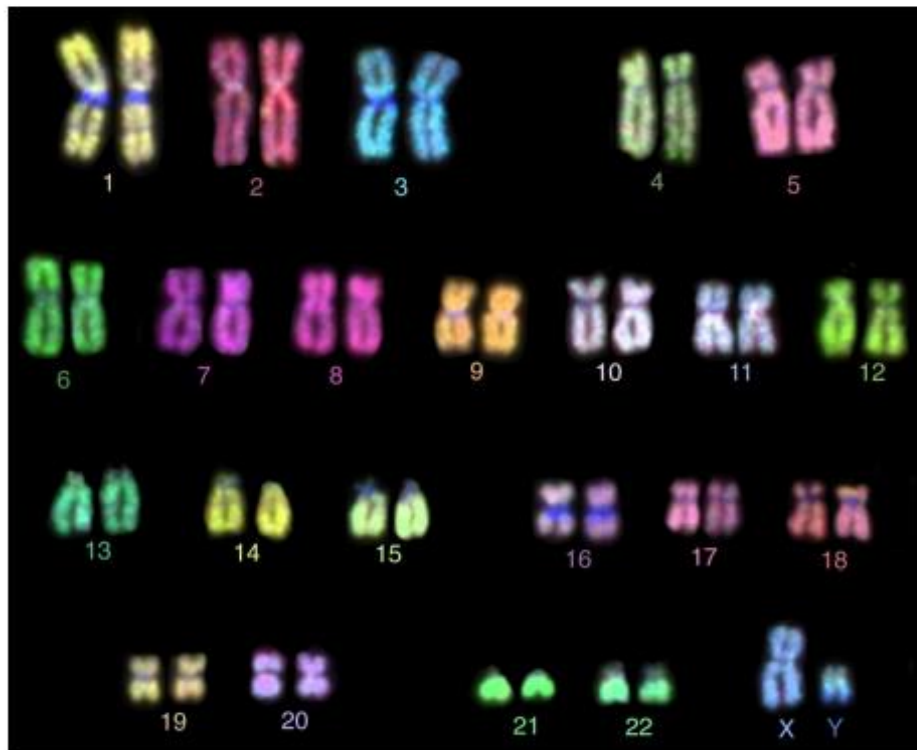



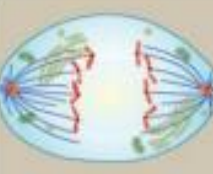
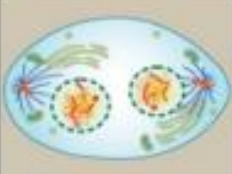

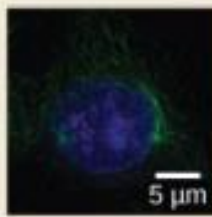
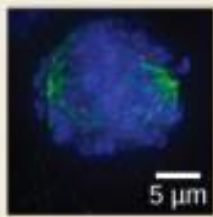
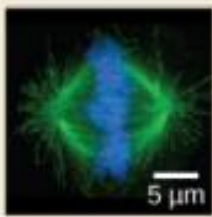
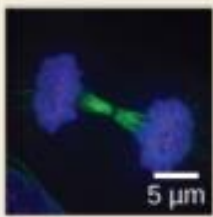
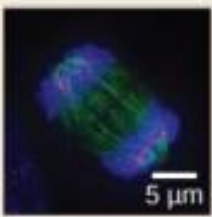



Diagram of a replicated and condensed **metaphase** eukaryotic chromosome. (1) **Chromatid** – one of the two identical parts of the chromosome after **S phase**. (2) **Centromere** – the point where the two chromatids touch. (3) Short arm (p). (4) Long arm (q).

- Human cells normally contains 23 pairs of chromosomes, for a total of 46. Twenty-two of these pairs, called autosomes, look the same in both males and females. The 23rd pair, the sex chromosomes, differ between males and females. Females have two copies of the [X chromosome](#), while males have one X and one [Y chromosome](#).

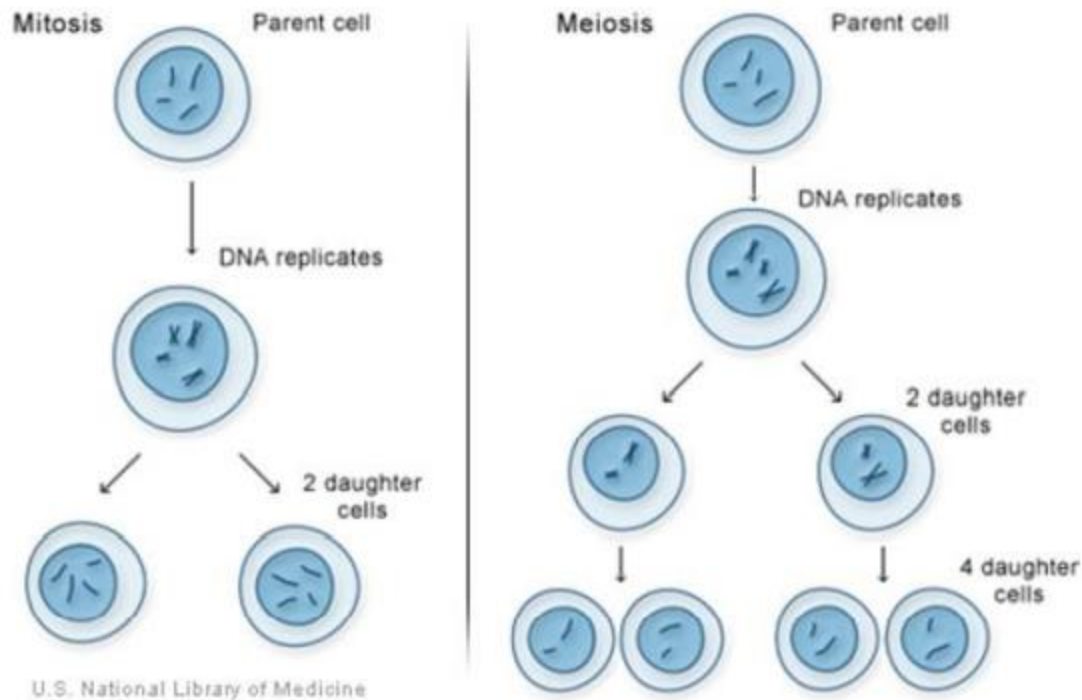


Human somatic cells undergo cell-dividing, this somatic cell nuclear and cell dividing is called MITOSIS --- 6 steps:

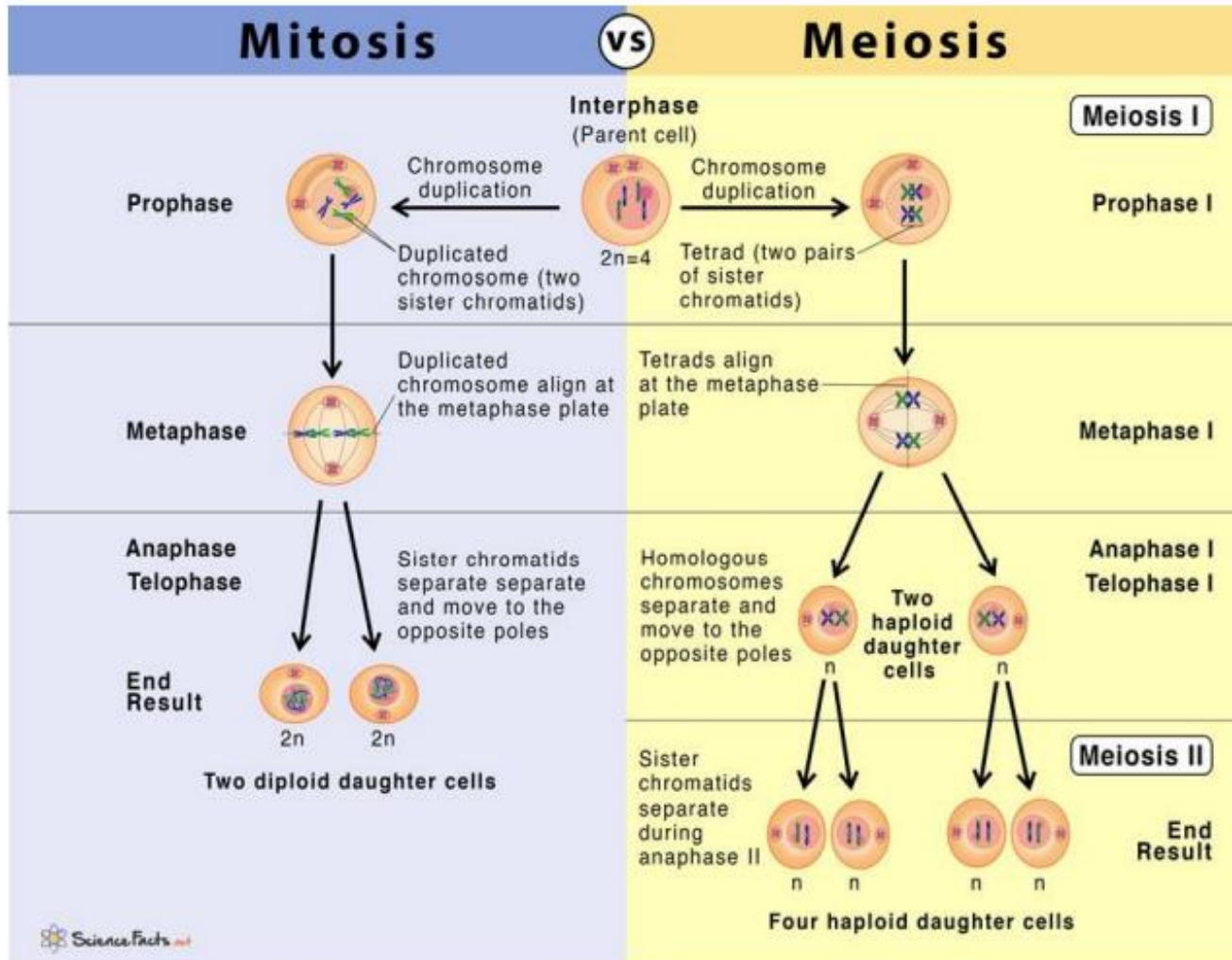
Prophase	Prometaphase	Metaphase	Anaphase	Telophase	Cytokinesis
					
<ul style="list-style-type: none"> Chromosomes condense and become visible Spindle fibers emerge from the centrosomes Nuclear envelope breaks down Nucleolus disappears 	<ul style="list-style-type: none"> Chromosomes continue to condense Kinetochores appear at the centromeres Mitotic spindle microtubules attach to kinetochores Centrosomes move toward opposite poles 	<ul style="list-style-type: none"> Mitotic spindle is fully developed, centrosomes are at opposite poles of the cell Chromosomes are lined up at the metaphase plate Each sister chromatid is attached to a spindle fiber originating from opposite poles 	<ul style="list-style-type: none"> Cohesin proteins binding the sister chromatids together break down Sister chromatids (now called chromosomes) are pulled toward opposite poles Non-kinetochore spindle fibers lengthen, elongating the cell 	<ul style="list-style-type: none"> Chromosomes arrive at opposite poles and begin to decondense Nuclear envelope material surrounds each set of chromosomes The mitotic spindle breaks down 	<ul style="list-style-type: none"> Animal cells: a cleavage furrow separates the daughter cells Plant cells: a cell plate separates the daughter cells
					
5 μm	5 μm	5 μm	5 μm	5 μm	5 μm

- Mitosis is not only way...also Meiosis exists

Two types of **cell division**



Please, learn what is typical for Prohphase, Metaphase, anaphase and Telophase. And what is DIPLOID and HAPLOID.

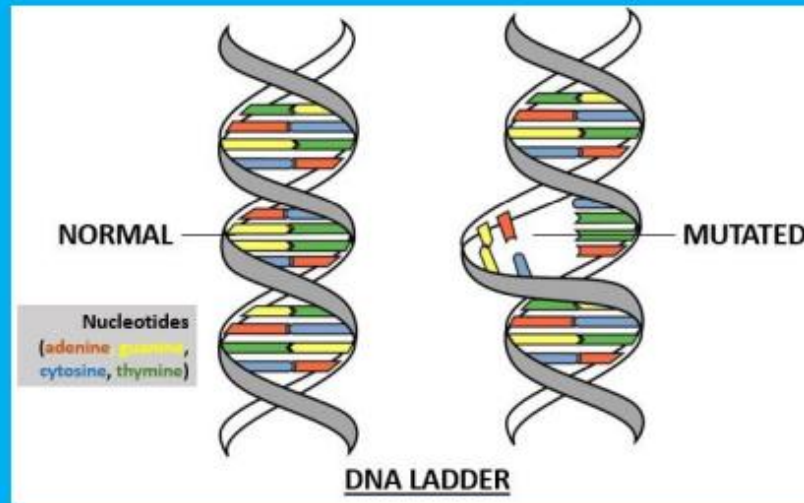


MUTATION

- *A mutation is a change that occurs in our DNA sequence, either due to mistakes when the DNA is copied or as the result of environmental factors (Gamma radiation, UV light and cigarette smoke...)*
- Often cells can recognise any potentially mutation-causing damage and repair it before it becomes a fixed mutation.
- Not all mutation had to be negative (positive mutation are axis of evolution in hisgtorical period)

MUTATION

- Mutation can be created during the DNA replication:

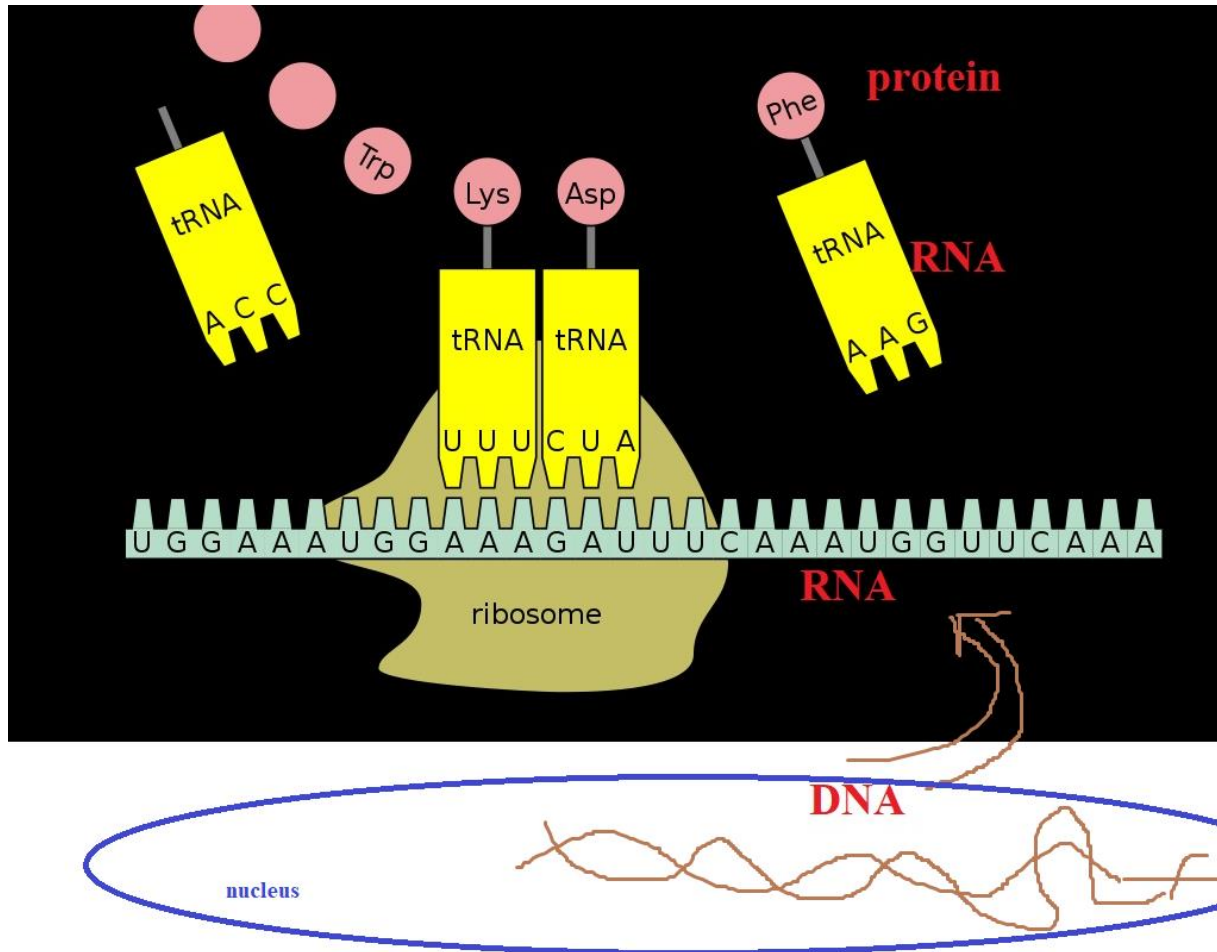


(on the picture: one possible type of mutation, several other types exist – overview in next pages)

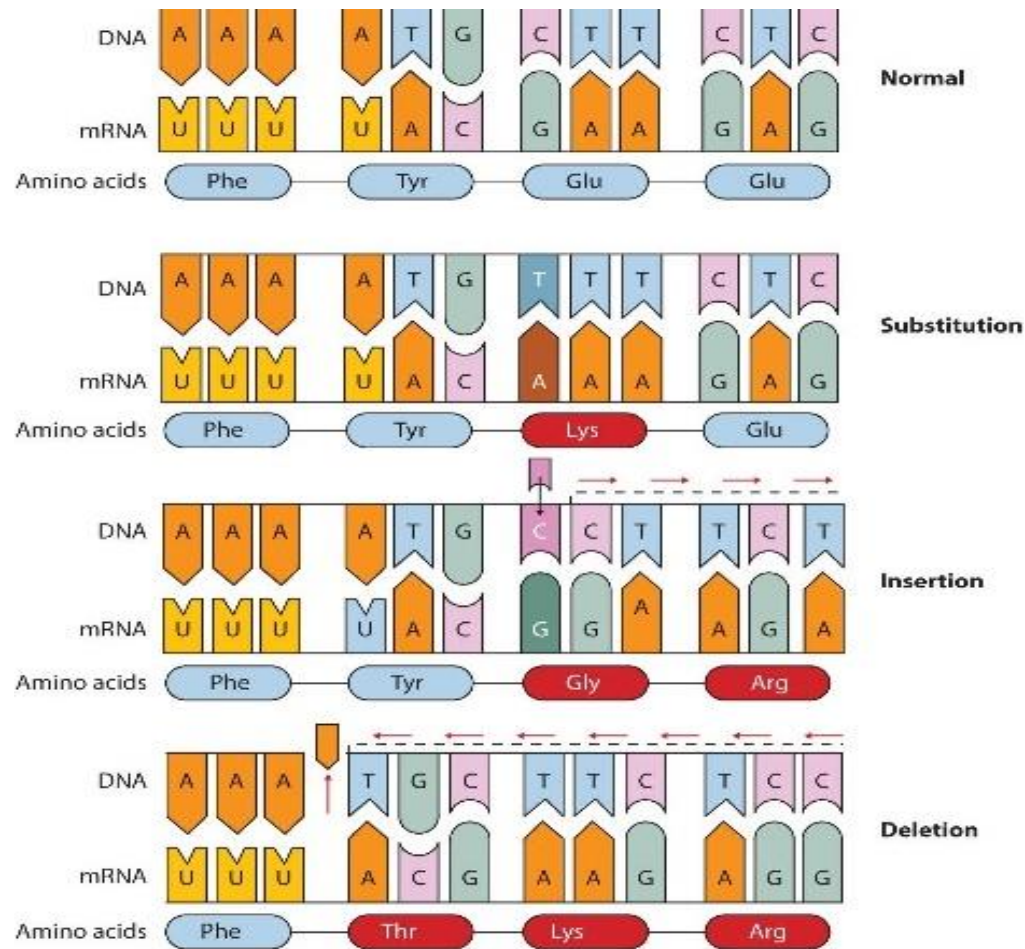
(Ad. Mutation)

- Each eukaryotic cells have systems for „error“ founding and elimination of part of DNA (or self-killing of the whole cells)
- „The body must survive, each one single cells had to be prepared for mutation elimination or selfkilling“

Mutation started in DNA code. What is make wrong, after mutation?? ...protein!



Mutation started in DNA code. What is make wrong, after mutation?? ...protein!



1st classification

From the view of “DNA code change”

- Substitution
- Insertion
- Deletion

1st classification

- Types of mutation from the view of the tissue:

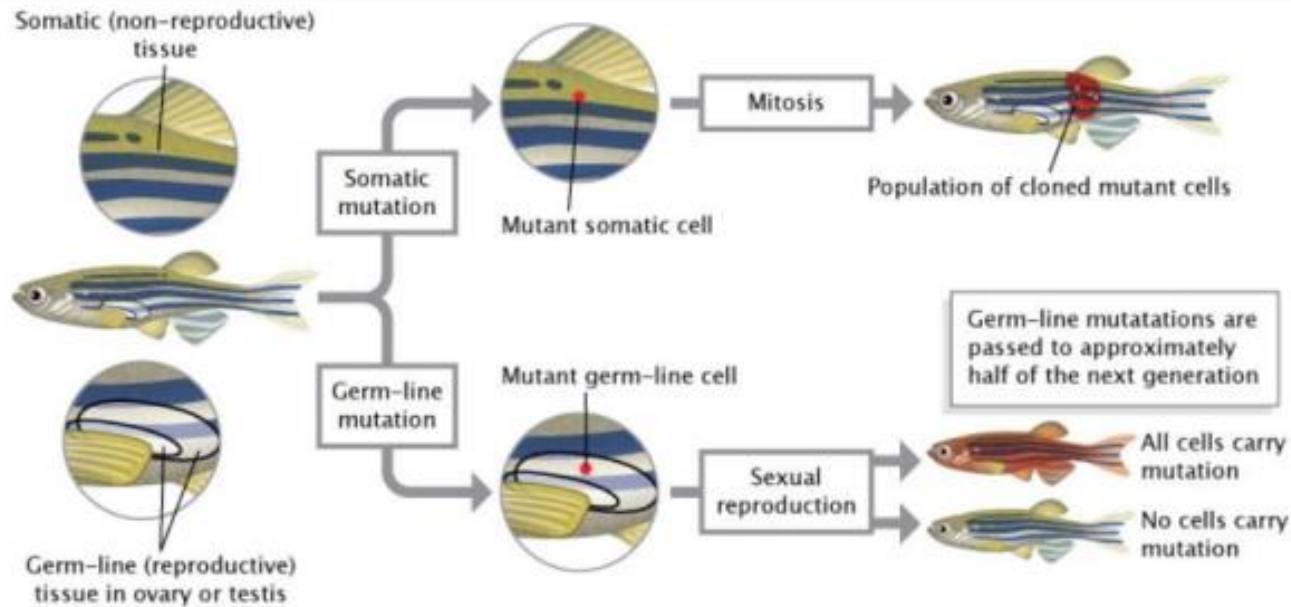
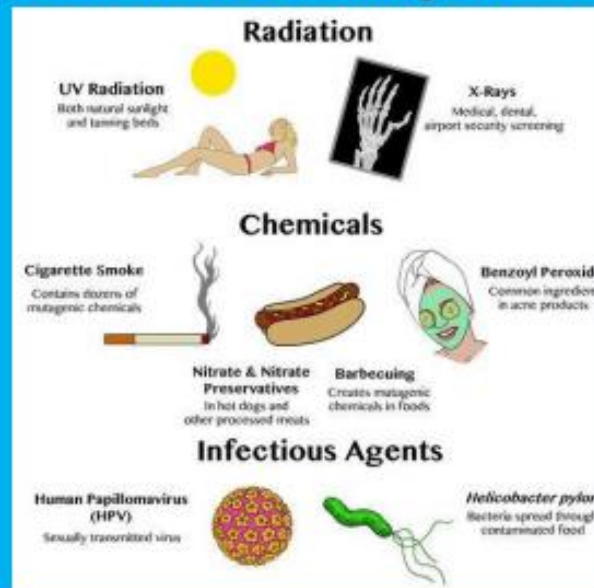


Figure 2: Mutations can occur in germ-line cells or somatic cells.

Germ-line mutations occur in reproductive cells (sperm or eggs) and are passed to an organism's offspring during sexual reproduction. Somatic mutations occur in non-reproductive cells; they are passed to daughter cells during mitosis but not to offspring during sexual reproduction.

Spontaneous vs. Induced mutation

INDUCED MUTATION: some external factor play role in increasing of mutation:



- !!There exist several types of mutation of DNA chain !!