Regulation of Cell Division in Normal Cells

Presented By:-

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ILOs:

1. Define cell division
2. List types of cell division
3. Define cell cycle
4. List stage of cell cycle
5. List stage of cell division
6. Explain the regulation of cell cycle
7. Describe defect could happen in cell cycle

What is the meaning of cell division?

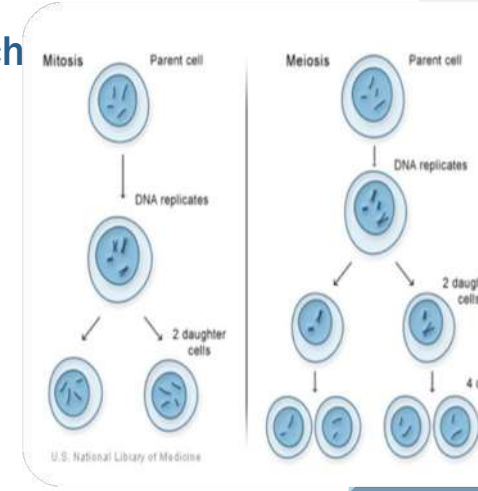
- Cell division is the process in which a parent cell divides, giving rise to two or more daughter cells.
- It’s done by multicellular organisms in order to grow, (repair), and reproduce.
- In unicellular organisms, a cell division is equivalent to reproduction.

Types of cell division:

There are two types of cell division:

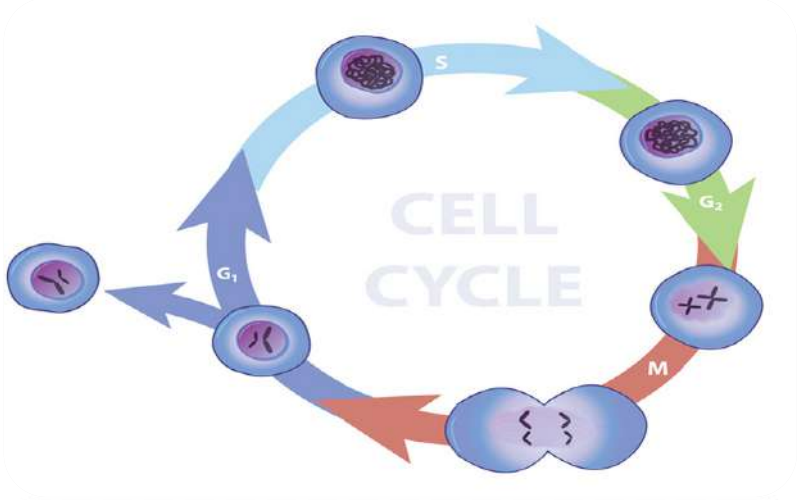
Mitosis: is a fundamental process for life. During mitosis, a cell duplicates all of its contents, including its chromosomes, and splits to form two identical daughter cells; when mitosis is not regulated correctly, health problems such as cancer can result.

Meiosis: meiosis, also called reduction division, division of a germ cell involving two fissions of the nucleus which gives four gametes, or sex cells, each possessing half the number of chromosomes of the original cell.



- # What is the cell cycle?

The cell cycle is a four-stage process; or it is the ordered sequence of events that occur in a cell in preparation for cell division.



• Stages of cell cycle :-

There are two main stages in the cell cycle.

The first stage is **interphase** during which the cell grows and replicates its DNA.

The second phase is the **mitotic phase** (M-Phase) during which the cell divides and transfers one copy of its DNA to two identical daughter cells

Interphase

This stage is divided into three parts: **G_1, G_2 and S phases..**

G_1 phase:

cells have split and the cells have only one copy of their DNA. Cells increase in size.

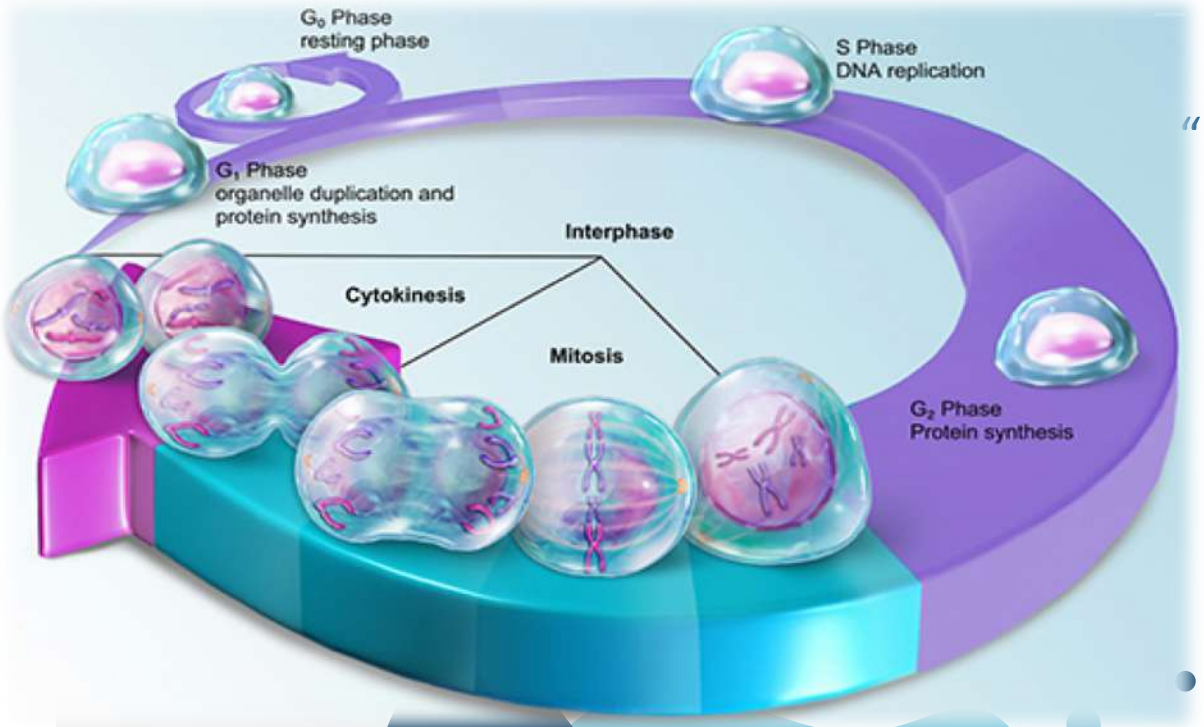
S phase:

Is the stage during which DNA replication occurs. and consist of long strands of DNA that contain the genetic information of the cell.

G_2 phase:

During this phase the cell may continue to grow and undergo normal cellular functions.

- **Stages of cell cycle:**



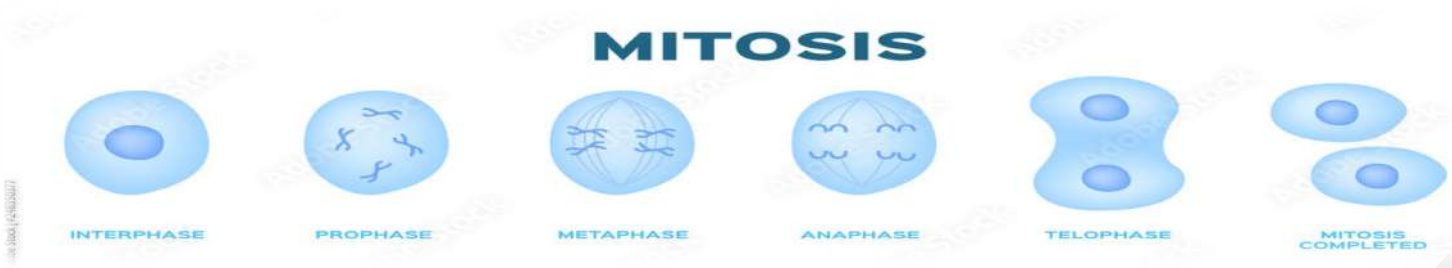
• Mitosis Phase:

- **The mitotic phase (M phase) is composed of two tightly coupled processes:**

(**mitosis** and **cytokinesis**)

which includes the four broad phases of mitosis :

(prophase , metaphase, anaphase, telophase, cytokinesis)



M- phase

Prophase.

During prophase, the **chromatin** material shortens and thickens into individual chromosomes which are visible under the light microscope.

Metaphase.

During metaphase, chromosomes line up on the **equator** of the cell.

The chromosomes appear in a straight line across the middle of the cell.

M- phase

Anaphase

During anaphase the chromatids are pulled to opposite poles of the cell by the shortening of the spindle fibers. The chromatids are now called **daughter chromosomes**.

Telophase

During telophase, a nuclear membrane reforms around the daughter chromosomes that have gathered at each of the poles.

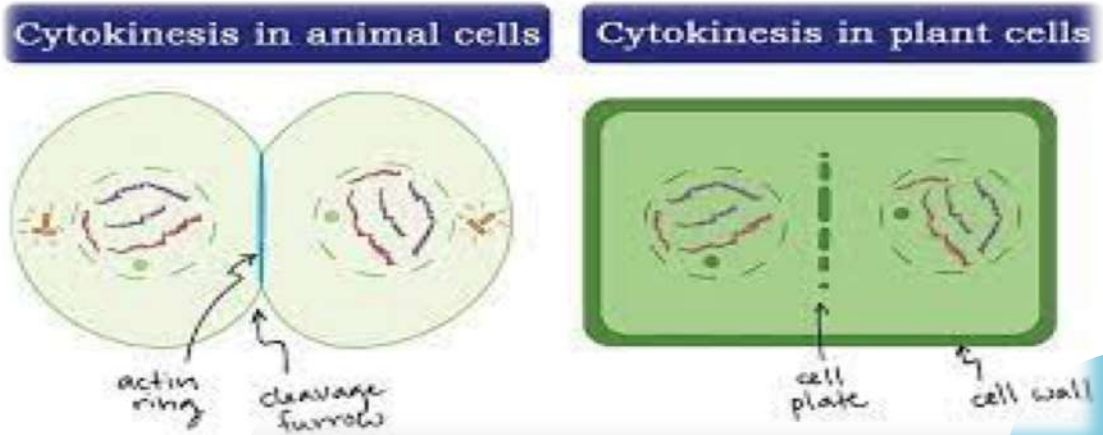
Cytokinesis

- the process of the cytoplasm splitting into two.

In an animal cell the cell membrane constricts.

This **invagination** or in-folding of the cytoplasm divides the cell in two.

In a plant cell a **cross wall** is formed by the **cell plate** dividing the cytoplasm in two

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Explain the Regulation of cell cycle

The cell cycle is controlled by regulator molecules that either promote the process or stop it from progressing

Positive regulation of cell cycle:

Two groups of proteins; cyclins and cyclin-dependent kinases (Cdks), are responsible for promoting the cell cycle

Maturation promoting factor (MPF):

MPF is composed of two protein complex; cyclin and cyclin dependent kinase (cdc2p).

These proteins are responsible for the progress of the cell through the various checkpoints.

Explain the Regulation of cell cycle:

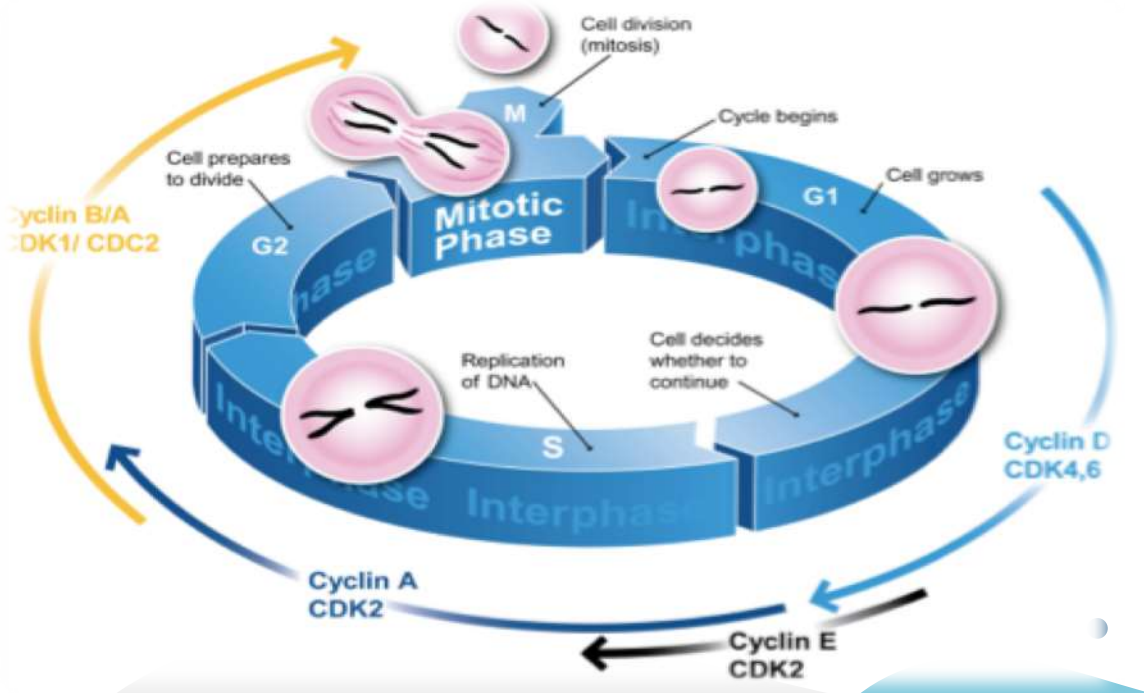
Cyclin:

Cyclins are cell-signaling molecules that regulate the cell cycle , After the cell moves to the next stage of the cell cycle, the cyclins that were active in the previous stage are degraded.

Cyclin dependent kinases(CDKs):

Cdks are kinase enzymes that phosphorylate other proteins or enzymes. Phosphorylation activates the protein by changing its shape.

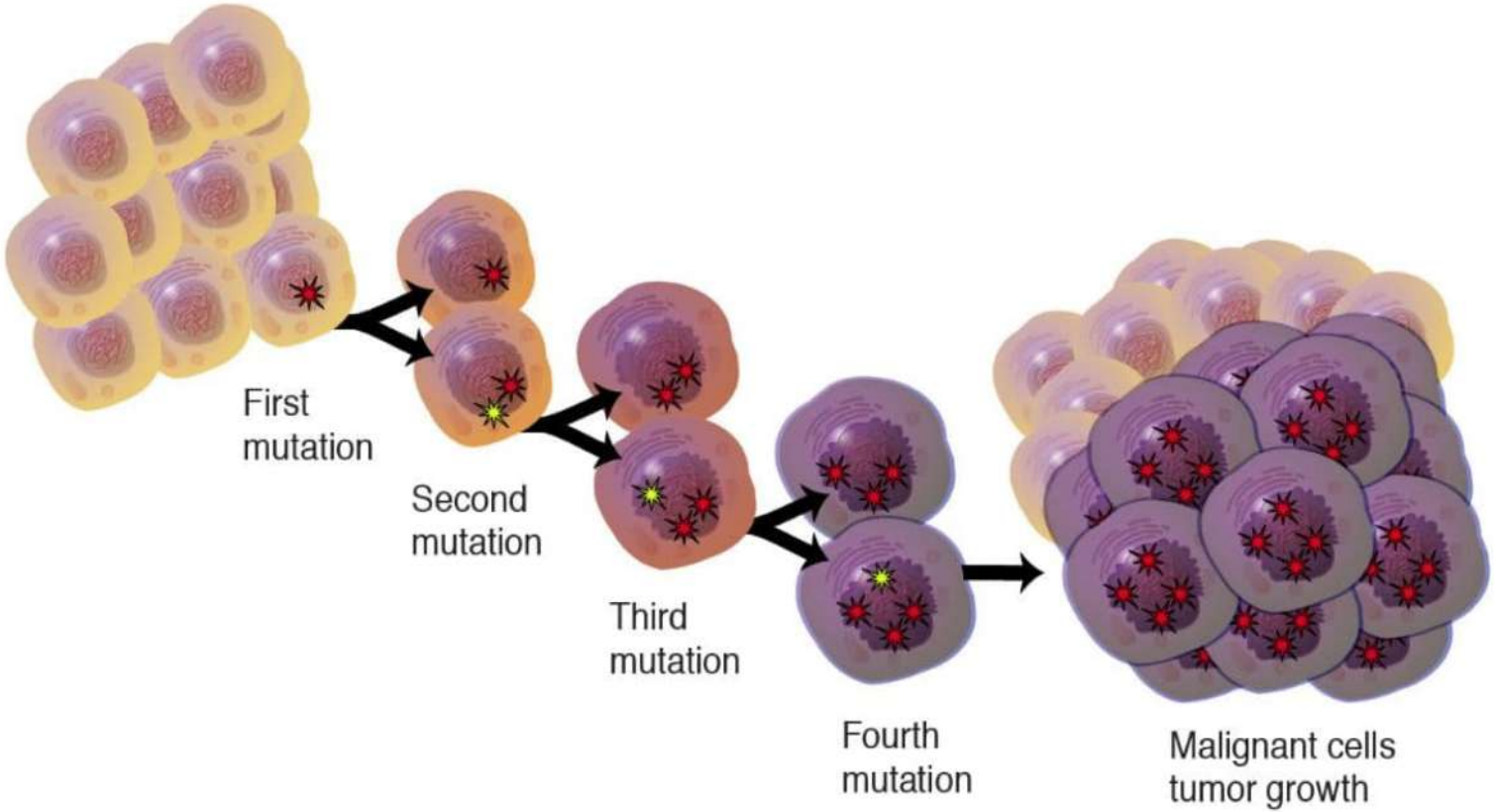
Regulation of cell cycle:



What defects could happen in cell cycle:

- **There are a lot of examples of defect in cell cycle but the most common is cancer.**

Cancer is a group of diseases characterized by uncontrolled cell growth. Cancer begins when a single cell mutates, resulting in a breakdown of the normal regulatory controls that keep cell division in check. These mutations can be inherited, caused by errors in DNA replication, or result from exposure to harmful chemicals. A cancerous tumor can spread to other parts of the body and, if left untreated, be fatal.


First
mutation
Second
mutation
Third
mutation
Fourth
mutation
Malignant cells
tumor growth

Summary

The cell cycle is a repeating series of events that cells go through.

Cell cycle consists of four stages: G1, S, G2, and M.

It includes growth, DNA synthesis, and cell division. In eukaryotic cells, there are two growth phases, and cell division includes mitosis and cytokinesis.

Mitosis has four sub-phases: Prophase , Metaphase ,Anaphase ,Telophase.

The cell cycle is controlled by regulatory proteins at three key checkpoints in the cycle.

Cancer is a disease that occurs when the cell cycle is no longer regulated.

Cancer cells grow rapidly and may form a mass of abnormal cells called a tumor.

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Thank you