الوراثة البشرية

العام الدراسي ٢٠٢٠-٢٠٢١

المحاضرة الاولى \ الانقسام الاعتيادي و اهميته

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وزارة التعليم العالي و البحث العلمي

Mitosis

- As we know that Eukaryote cell divide and reproduce in two ways these are mitosis and meiosis.
- In this lecture we will talk about Mitosis, but before we will talk about mitosis we should learn what are the following basic genetic term means / Gene , somatic cell , gamete , chromosome , diploid cell , haploid cell , homologous chromosome , chromatid and finally centromere.
- You can find the brief definition of these basic genetic terms in your booklet – Chapter 1 – page one.

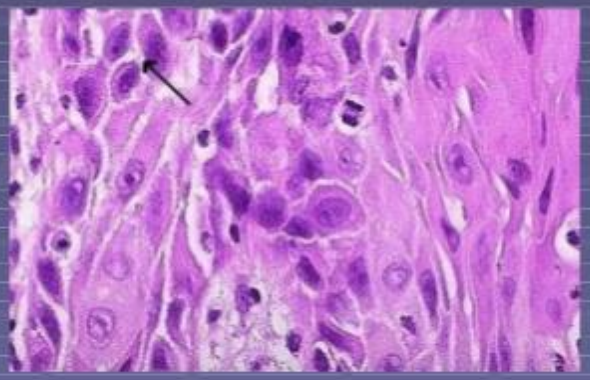
- **Mitosis occurs in the following circumstances:**

1. **Development and growth.**
2. **Cell replacement.**
3. **Regeneration.**
4. **Asexual Reproduction**

Cell Division by mitosis

- Some cells divide constantly: cells in the embryo, skin cells, gut lining cells, etc.

7 week old embryo

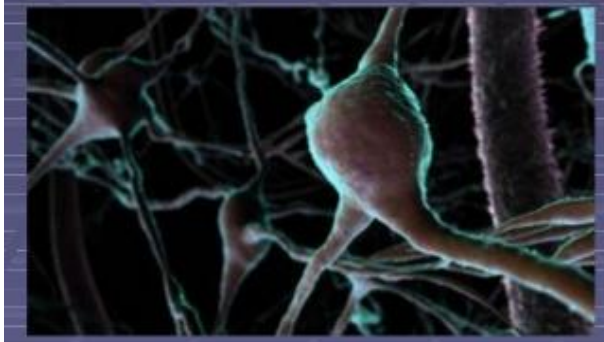


Epithelial Cell

Intestinal Cell

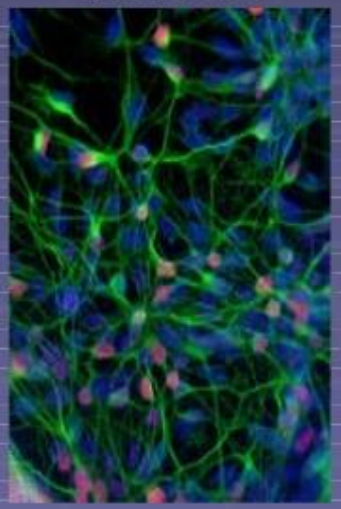
Cell Division

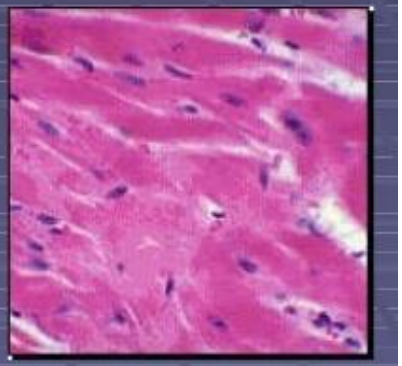
- Other cells divide rarely or never.



Brain Cell – Nerve cell

Spinal Cord Cell- Nerve cell





Cardiac Cell

(Heart Muscle)

MITOSIS PHASE

Interphase: , is actually a period of diverse activities Lasts at least 12 to 24 hours in mammalian tissue. Can be divided into 4 steps:

Gap 0 (G0) This may be a temporary resting period or , more permanent (will no longer divide (e.g. neuron).

. Gap 1 (G1): Produce RNA and synthesize

protein including the enzymes.*An important cell cycle control (G1Checkpoint) ensures that everything is ready for DNA synthesis

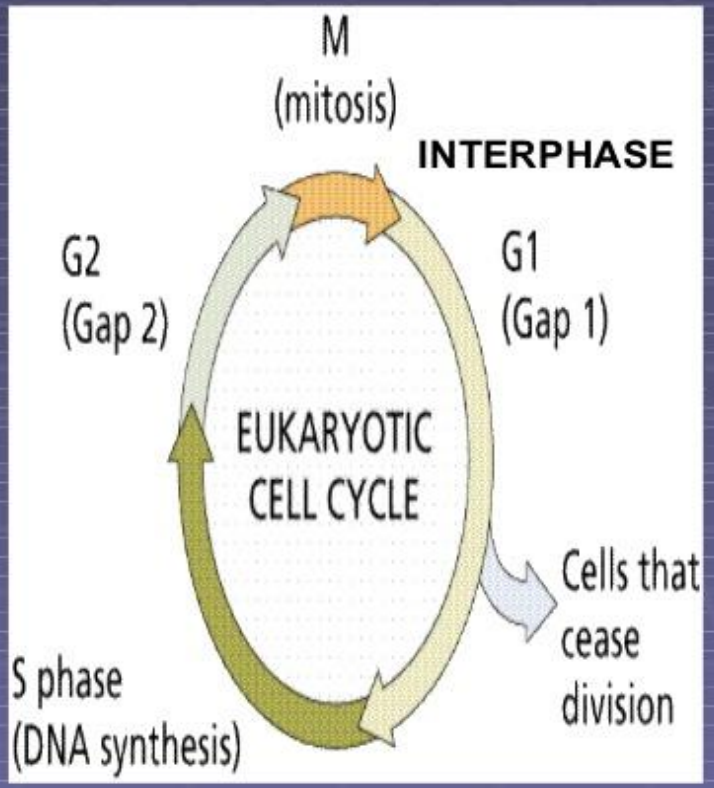
S Phase: DNA replication occurs during this S (synthesis) phase ,chromosomes duplicates .

Gap 2 (G2):The cell will continue to grow and produce new proteins.

*** At the end of this gap is another control checkpoint (G2 Checkpoint) to determine if the cell can now proceed to enter M (mitosis) and divide**

Cell Cycle

- A typical cell goes through a process of growth, development, and reproduction called the cell cycle.
- Most of the cycle is called interphase.



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- **Mitosis or M Phase: Cell growth and protein production stop .Lasting only one to two hours, there is a (Metaphase Checkpoint) that ensures the cell is ready to complete cell division**

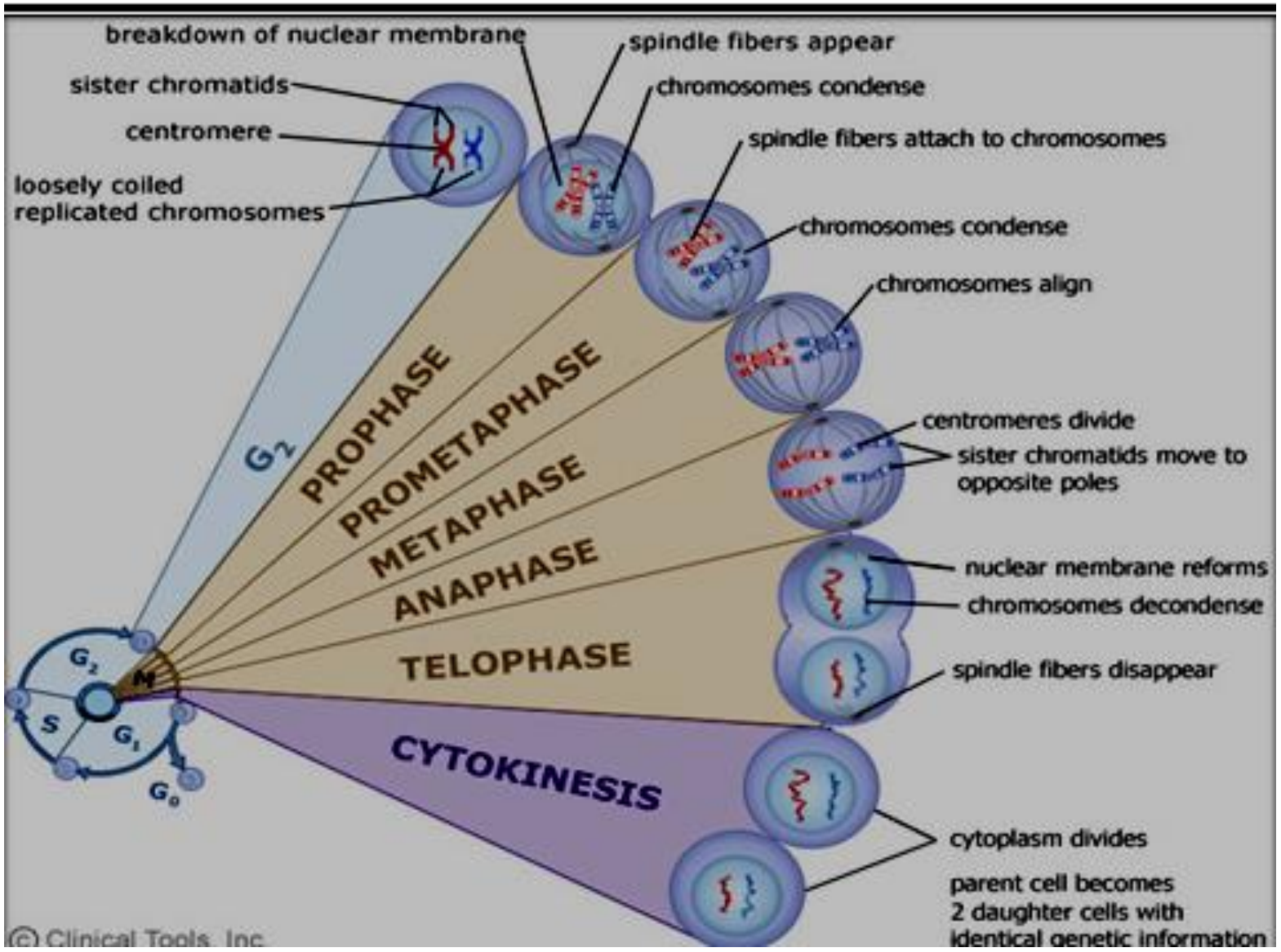
- **Prophase:**
- **1-The centrosomes move to opposite poles,**
- **2- the nuclear envelope fragments,**
- **3- and chromosomes condense and become visible. Having undergone DNA replication, each chromosome consists of two chromatids joined at their centromere regions by a kinetochor**
- **protein complex**

- **Metaphase: Tension applied by the spindle fibers aligns all chromosomes in one plane at the center of the cell.**

Anaphase: Spindle fibers shorten, the kinetochores separate, and the chromatids (daughter chromosomes) are pulled apart and begin moving to the cell poles.

- **Telophase: The daughter chromosomes arrive at the poles and the spindle fibers that have pulled them apart disappear.**

- **Cytokines is: a contractile ring cleaves the cell into two daughter cells. Microtubules then reorganize into a new cytoskeleton for the return to interphase.**


breakdown of nuclear membrane
spindle fibers appear
sister chromatids
chromosomes condense
centromere
spindle fibers attach to chromosomes
loosely coiled
replicated chromosomes
chromosomes condense
chromosomes align
centromeres divide
sister chromatids move to
opposite poles
nuclear membrane reforms
chromosomes decondense
spindle fibers disappear
cytoplasm divides
parent cell becomes
2 daughter cells with
identical genetic information
G2
PROPHASE
PROMETAPHASE
METAPHASE
ANAPHASE
TELOPHASE
CYTOKINESIS
G2
M
S
G1
G0
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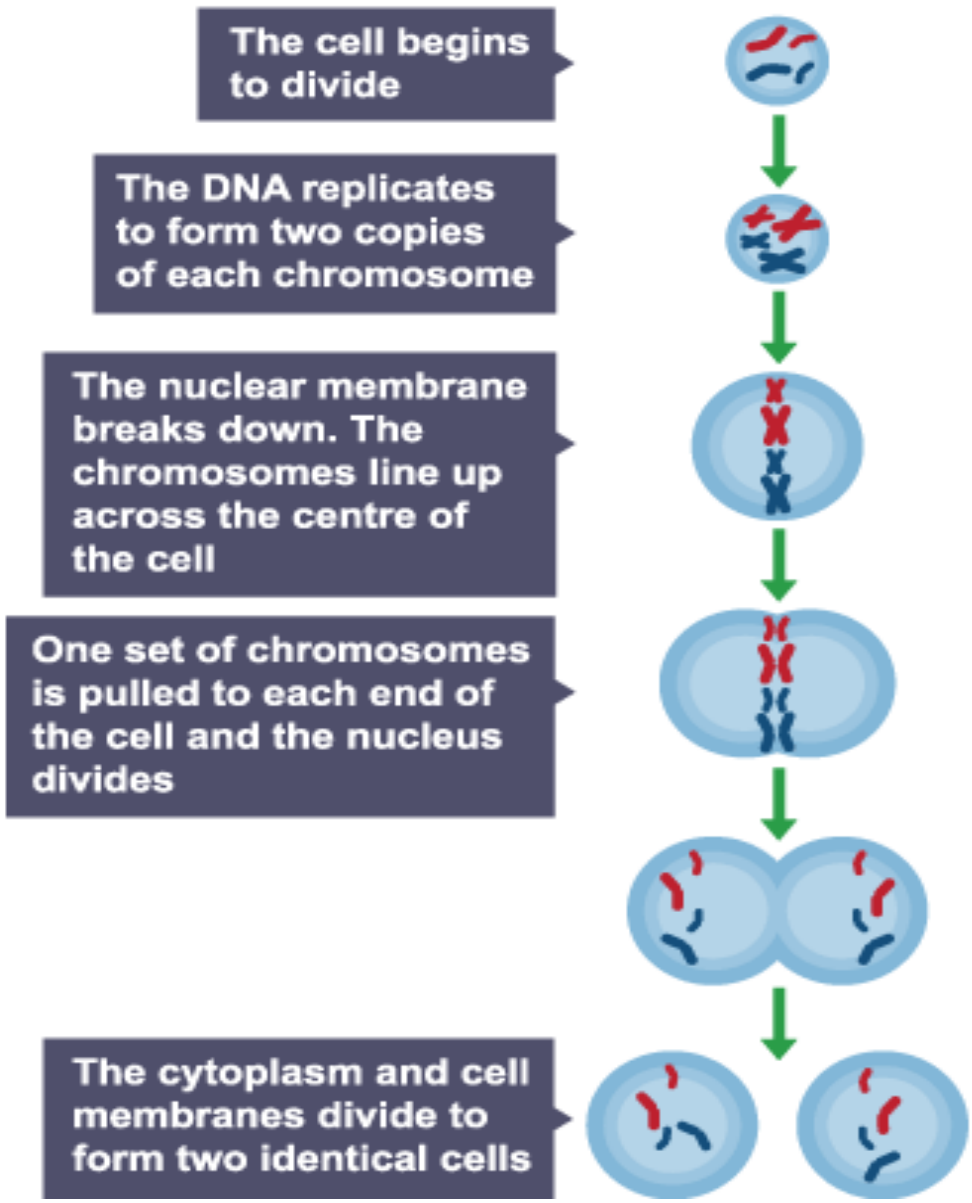
The cell begins to divide
The DNA replicates to form two copies of each chromosome
The nuclear membrane breaks down. The chromosomes line up across the centre of the cell
One set of chromosomes is pulled to each end of the cell and the nucleus divides
The cytoplasm and cell membranes divide to form two identical cells

THE CELL CYCLE

Dividing eukaryote cell pass through a series of a stages known as the cell cycle: two gap phases (G1 and G2) , an S phase and an M phase.

Mitosis / Is a process of cell division that results in two genetically identical daughter cells developing from single parent cell.

The separation of the genetic material in a mitotic nuclear division also known as karyokinesis is followed by a separation of the cell cytoplasm in a cellular division or cytokinesis to produce two daughter cells.

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- **Mitosis although a continuous process, is conventionally divided into five stages : prophase , prometaphase , metaphase , anaphase , and telophase.**
- **Cytokinesis**
- **The final cellular division to form two new cells. In plants a cell plate forms along the line of the metaphase plate; in animal there is a constriction of the cytoplasm.**
- **Mitosis, although a continuous process, is conventionally divided into five stages.**

- Errors produced during the mitotic anaphase
- The normal proceeding of events in anaphase may be perturbed because of some ""anaphase accidents"", which cause the errors in distribution of genetic material.
- Types of errors
- • Transversal cleavage of centromere
- • Chromatidian non-disjunction
- • Anaphase lag.
- Evolution of abnormal cell clones and phenotypic consequences.
- 1. Evolution depends on viability of cell.
- • Severe anomalies lead to death of affected cells by self - elimination.
- • Less severe abnormalities which are induce the appearance of abnormal cell clones.
- 2. Evolution depends on stages.
- • Congenital malformation are produced if they appear during embryo development.
- • Perturbation of normal organ structure and function occurs if they appear in postnatal period, (e.g. leading to neoplasm-cancer).

Thanks for your listening

Dr. Ayad