



الوراثة الطبية 1 / الكورس الاول

Mitosis

Sawa University

جامعة ساوة الاهلية

College of health and medical techniques

كلية التقنيات الصحية والطبية

Department of Medical Laboratories

قسم تقنيات المختبرات الطبية

Third Stage

المرحلة الثالثة

محاضرة رقم 3

الجانب النظري : الوراثة الطبية

Lecture No. 3

Theoretical : Medical Genetics

تدريسي المادة : م. د عباس علي

Learning Objectives

By the end of this lecture, you will be able to:

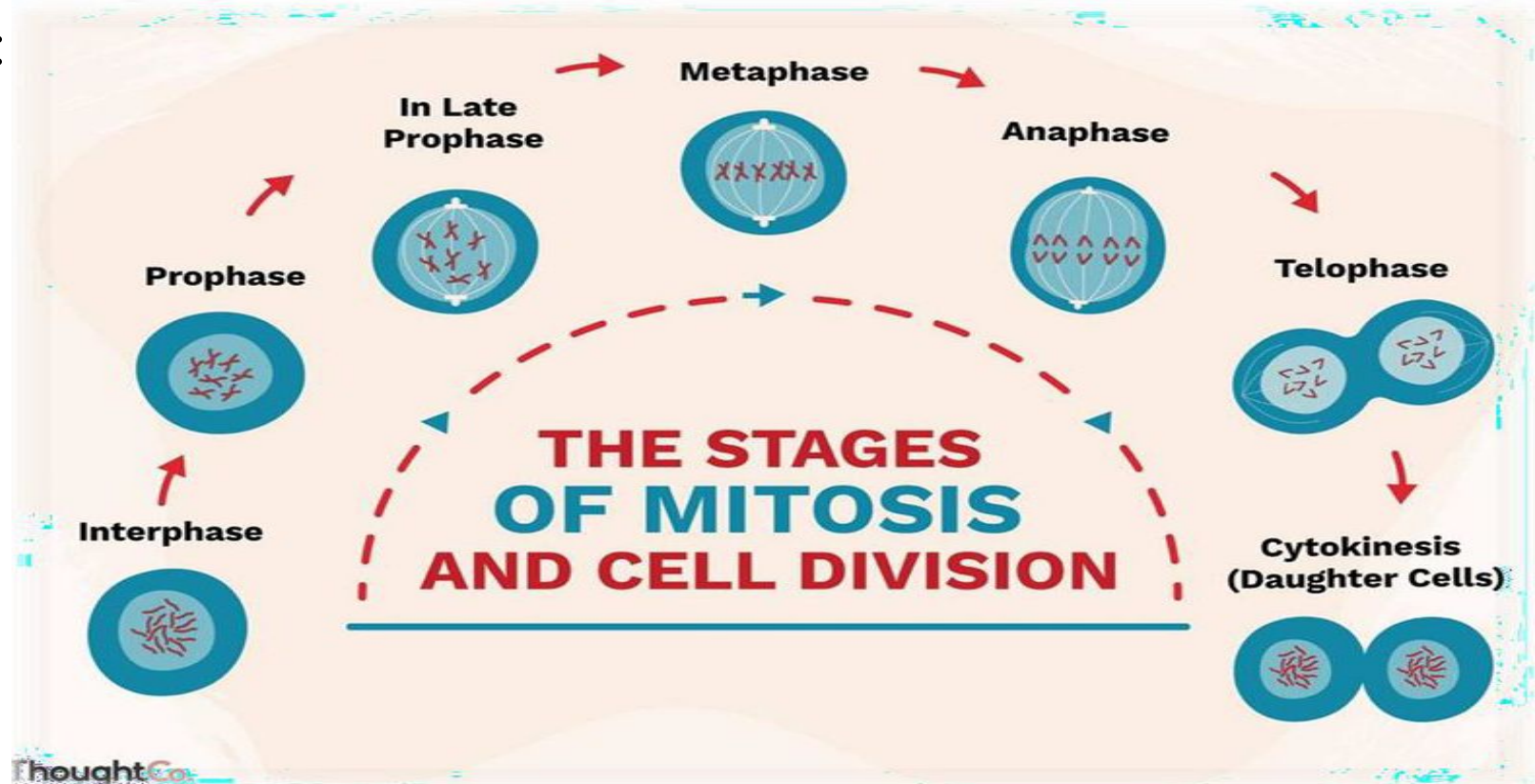
- Defines the concept of mitosis and its biological importance.
- Describes the main stages of mitosis in the correct sequence.
- Identifies the most important changes that occur to the nucleus and chromosomes during each stage.
- Explains the final outcome of mitosis and its impact on cell growth and renewal.

Mitosis

Mitosis: is the process by which a eukaryotic cell divides its nucleus and duplicated chromosomes into two identical sets. It ensures that each daughter cell receives an identical copy of the genetic material.

- **Mitosis it has 4 sub-phases:**

- 1st - Prophase
- 2nd - Metaphase
- 3rd - Anaphase
- 4th - Telophase
- Cytokinesis



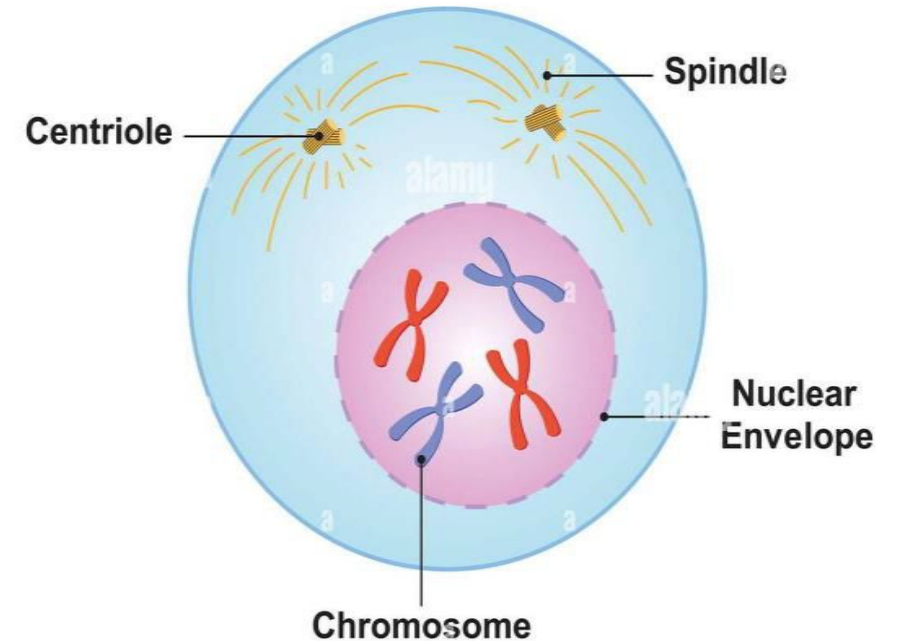
Prophase

1- Prophase

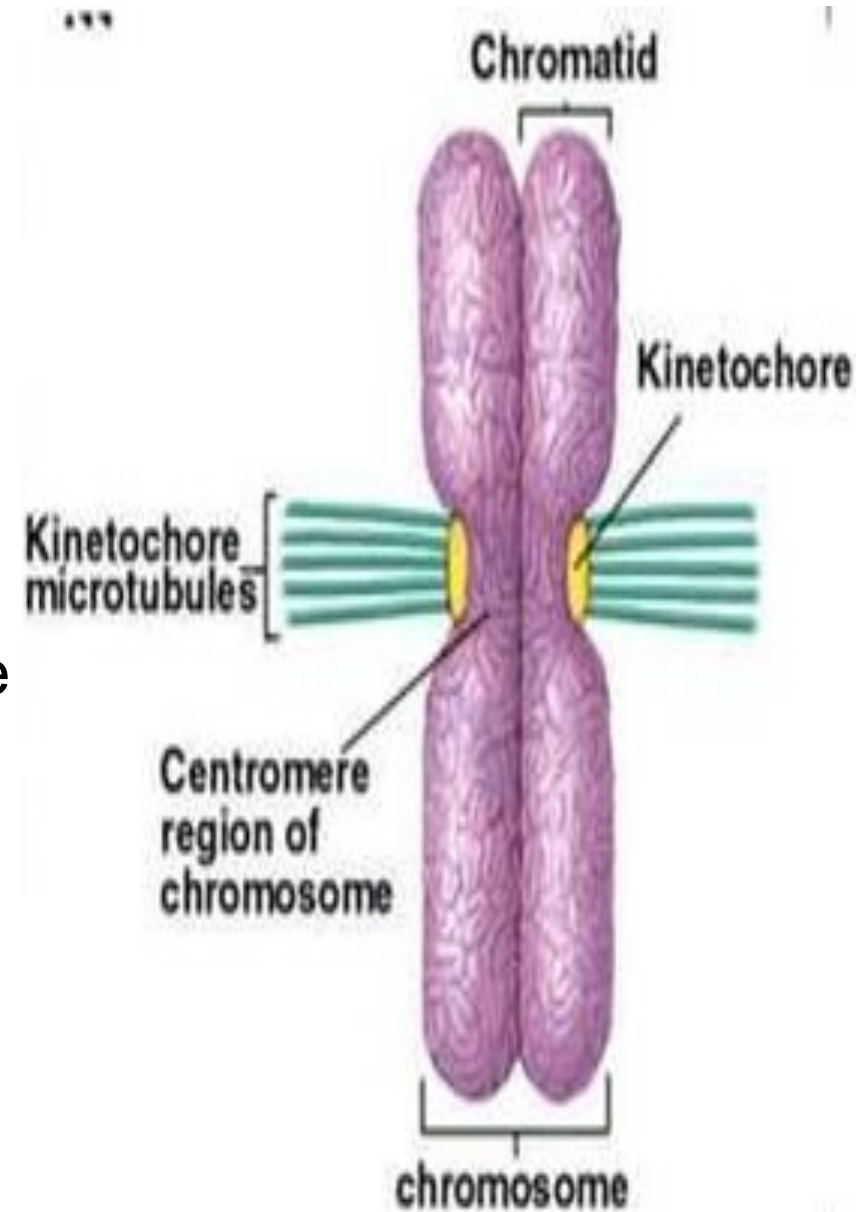
Events of Prophase:

- Chromatin condenses into visible chromosomes.
- Each chromosome consists of two sister chromatids joined at the **centromere**.
- The **nuclear envelope** begins to break down.
- The **nucleolus** disappears.
- **Spindle fibers** start to form from centrioles (in animal cells).
- Spindle fibers attach to the chromosomes at their kinetochores.

Prophase



- **Kinetochores** are a complex protein structure formed on the centromere of each chromosome after DNA replication.
- **Location:** Situated at the narrow region of the chromosome where the sister chromatids are joined.
- **Function:**
 - Connects the **spindle fibers** to the chromosome during cell division (**Mitosis** and **Meiosis**).
 - Pulls the **sister chromatids** toward the poles of the cell during **Anaphase**.
 - Acts as a **control center** to ensure proper attachment of the chromosome to the spindle before the chromatids are separated.

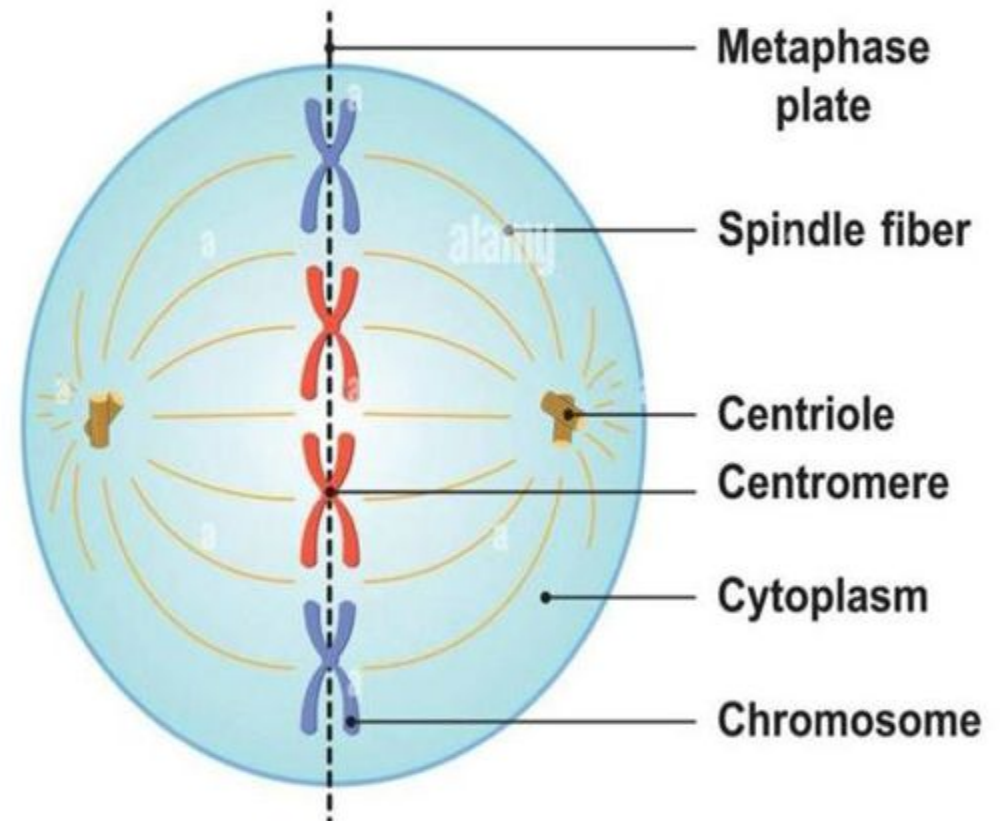


metaphase

2- metaphase

- Chromosomes align along the **equatorial plate** (metaphase).
- Each chromosome is attached to spindle fibers from opposite poles.
- The alignment ensures equal separation of chromosomes later.
- The cell prepares for chromatid separation.

Metaphase



Anaphase

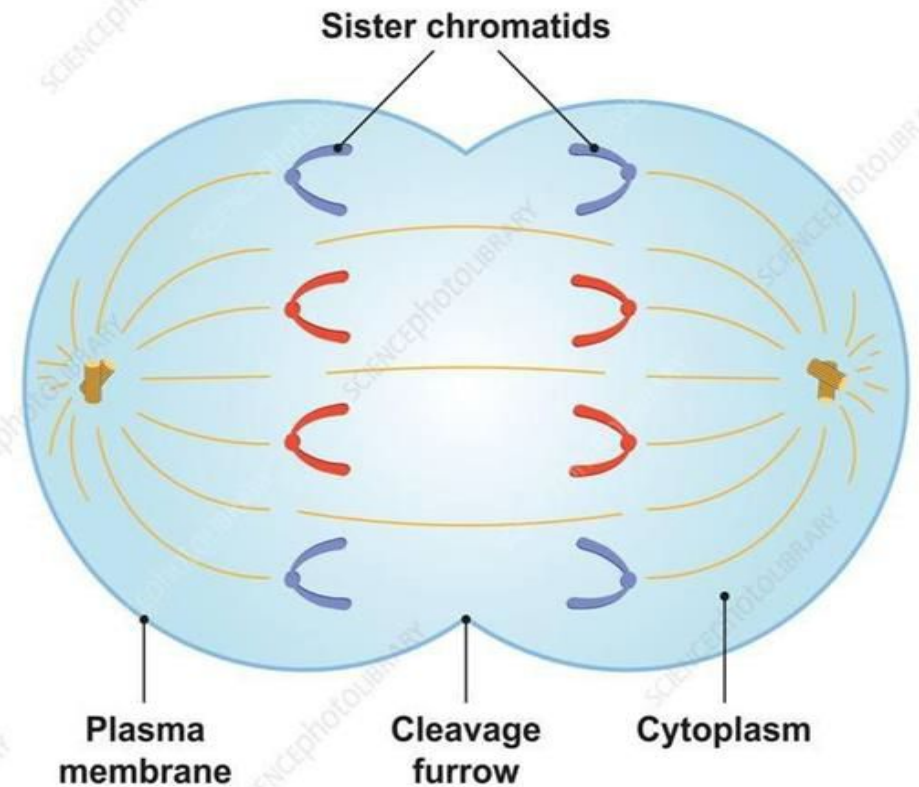
3- Anaphase

1-Spindle fibers attached to kinetochores shorten and pull the chromatids towards the opposite poles.

2-In the anaphase stage, the **sister chromatids separate** from each other.

3-The cell appears almost **oval in shape** as it starts becoming longer.

Anaphase

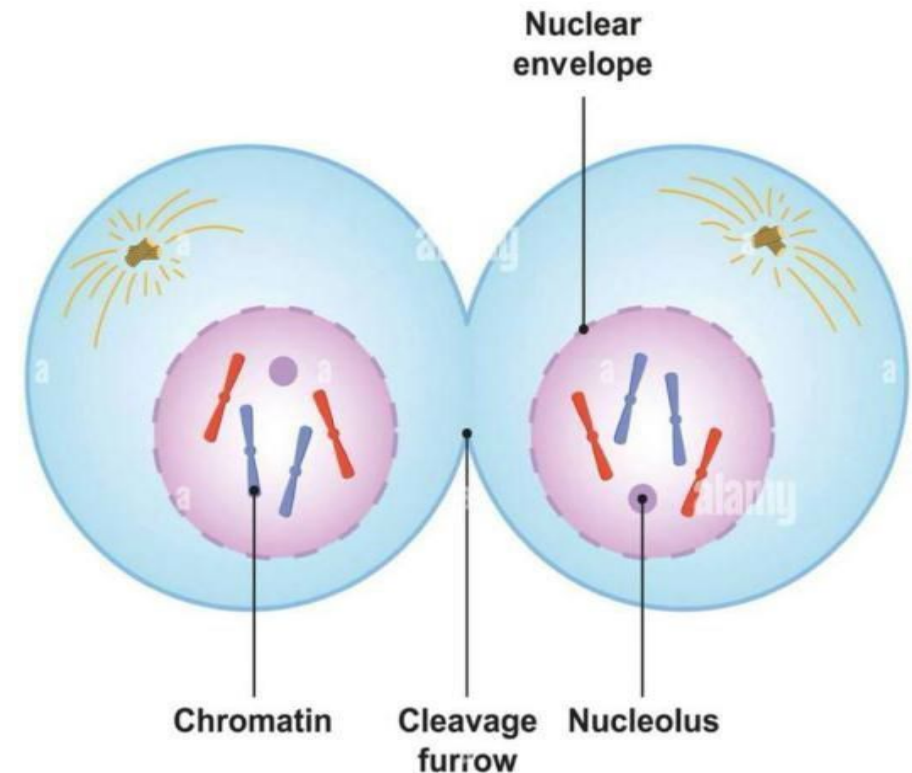


Telophase

Telophase

4- Telophase

1. Chromosomes reach opposite poles and begin to decondense.
2. Nuclear membranes reform around each set of chromosomes.
3. Spindle fibers disappear.
4. Two nuclei are now visible.
5. Nucleolus is appear.



cytokinesis

Cytokinesis is the final stage of the normal cell cycle, during which the cytoplasm of a parent cell divides to form **two genetically identical daughter cells**, each with its own cell membrane and organelles.

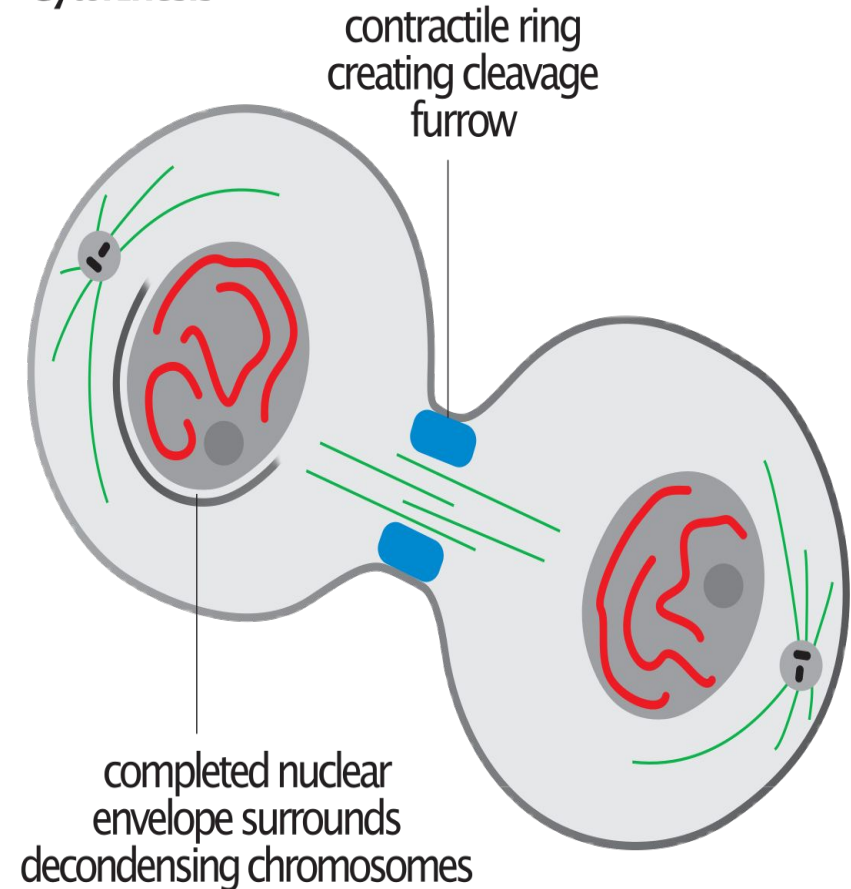
1-Cytokinesis is the **last phase** of the normal cell cycle.

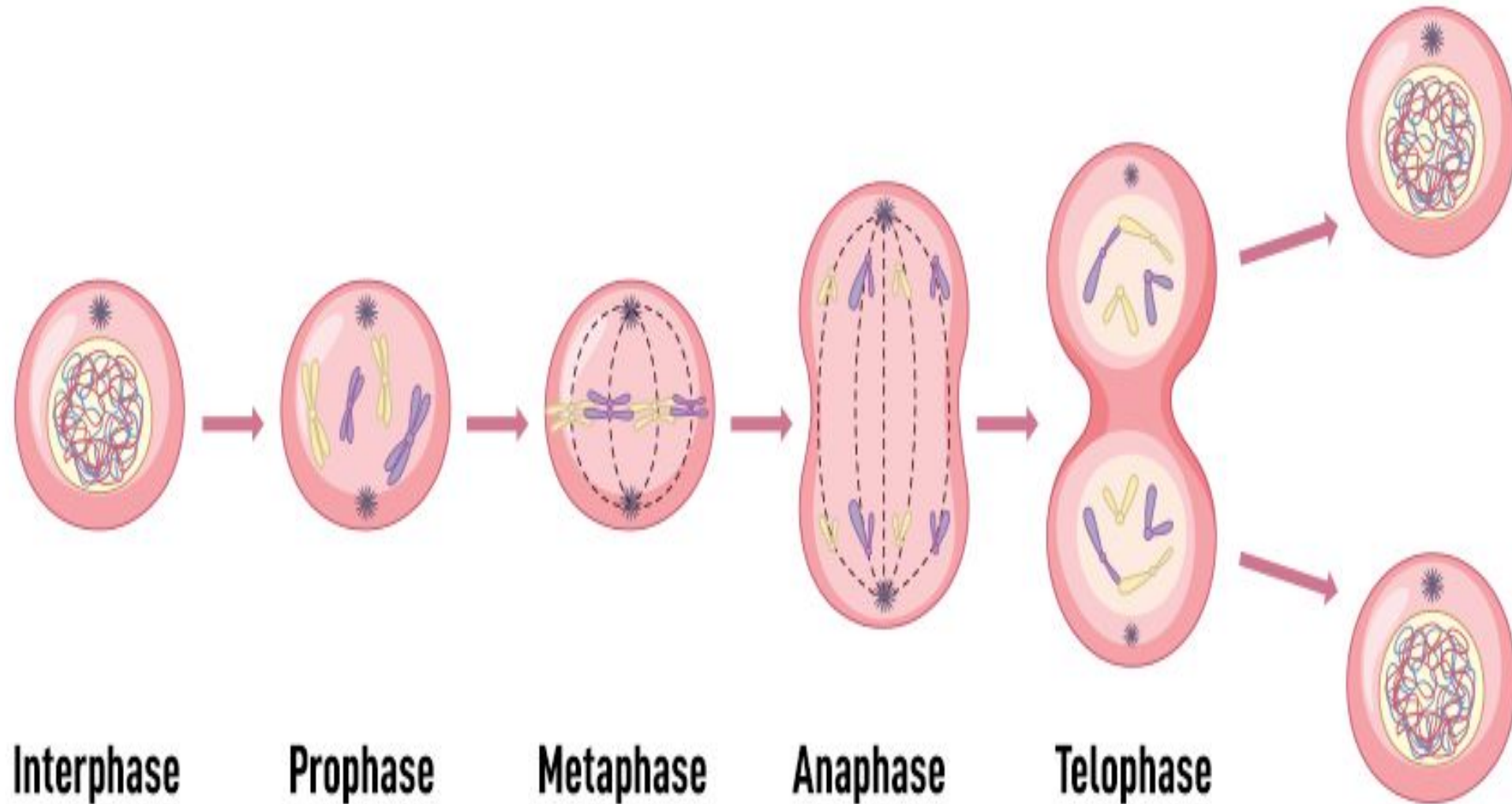
2-In this phase the Cytokinesis **cell divides** into two identical daughter cells.

3- In human cells, cytokinesis occurs when the cell membrane constricts at the center, gradually dividing the cytoplasm until two separate daughter cells are formed.

4-In both new cells the **DNA is identical**.

Cytokinesis





Phases of Mitosis

The key features of mitosis in a structured format:

- **Main purpose:** To produce two genetically identical daughter cells with the same number of chromosomes as the parent cell.
- **Number of divisions:** One nuclear division per cell cycle.
- **Number of resulting cells:** Only two daughter cells.
- **Chromosome number:** Remains constant (46 chromosomes in humans).
- **Genetic variation:** No genetic recombination (crossing-over); daughter cells are genetically identical to the parent cell.
- **Phases:** Prophase → Metaphase → Anaphase → Telophase (followed by Cytokinesis).
- **Function:** Growth, tissue repair, and cell renewal in multicellular organisms

Any questions?

*Thank
You*