

CELL **C**YCLE

AND

CELL **D**IVISION

Dear Students ,

- This is an important lesson from your 11 th standard . So I have prepared Ppt for the lesson cell cycle and cell division .
- This is Module 1 .Other half of the lesson will be given as the next module .
- Go through the slides and revise the topics again .
- I have added photos and have given a link for the video to understand it better .
- Learn the topic and do the assignments given at the end .
- It will be helpful for 12 std

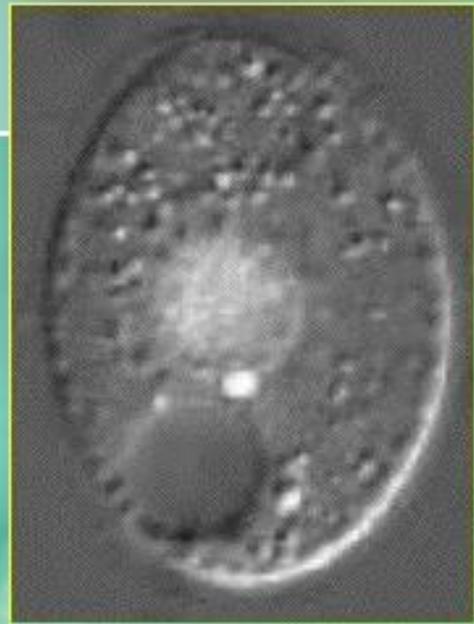
Thank you .All the Best Students .

➤ **Growth & reproduction are characteristics of cells.**

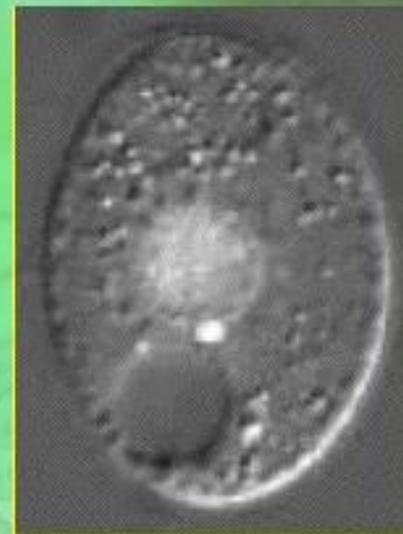
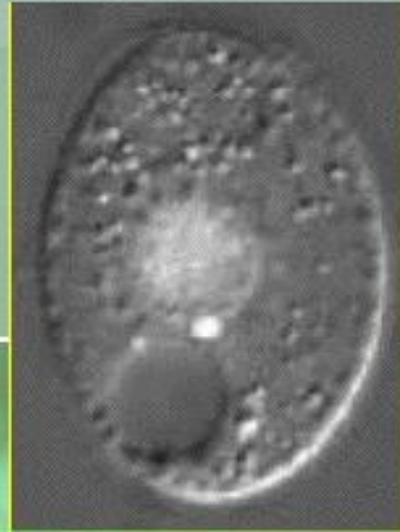
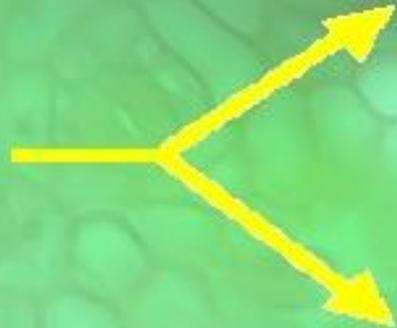
All cells reproduce by dividing into two, with each parental cell giving rise to two daughter cells each time they divide.

These newly formed daughter cells grow and divide, giving rise to a new cell population .

Identical Daughter Cells



Parent Cell



*Two
identical
daughter
cells*

CELL CYCLE:

The sequence of events by which a cell duplicates its genome, synthesises the other constituents of the cell and eventually divides into two daughter cells is termed **cell cycle**.

Cell cycle includes three processes:

Cell division,

DNA replication

Cell growth

in a coordinated way.

Duration of cell cycle can vary from organism to organism and also from cell type to cell type.

In Yeast cell cycle is of 90 minutes & in Human 24 hrs.

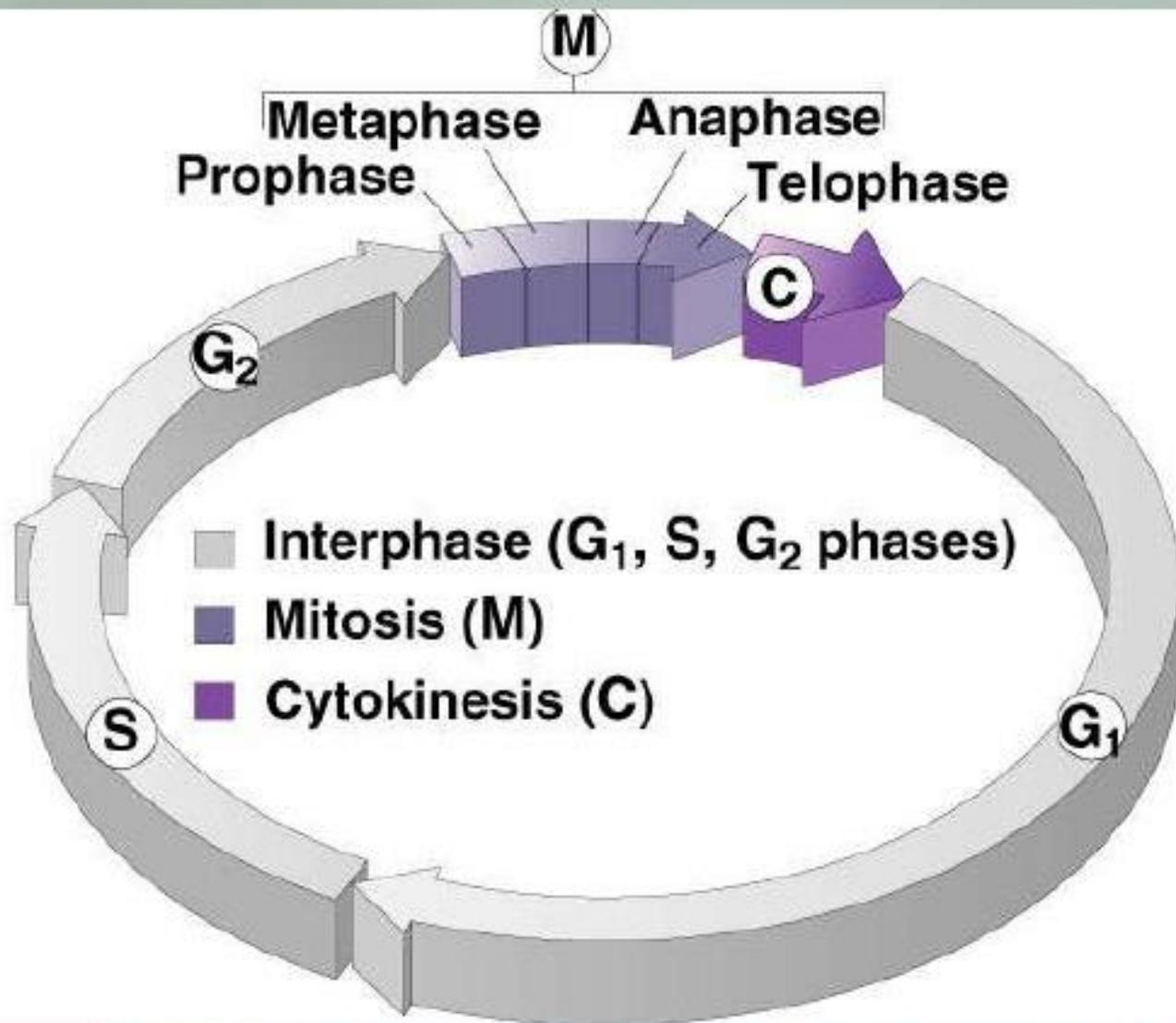
Five Phases of the Cell Cycle

- ✓ G_1 - primary growth phase
- ✓ S - synthesis; DNA replicated
- ✓ G_2 - secondary growth phase

collectively these 3 stages are called interphase

- ✓ M - mitosis
- ✓ C - cytokinesis

Cell Cycle



Cell cycle

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graph TD; A[Cell cycle] --> B[Interphase]; A --> C[M phase (mitosis phase)]; B --> D["• Phase between two successive M phases.  
• Lasts for 95% of total duration of cell cycle.  
• Also called resting phase but Cell prepare itself for division by undergoing both cell growth and DNA replication."]; C --> E["• The actual cell division or mitosis occurs  
• Lasts for 5% of total duration of cell cycle  
• Starts with nuclear division and ends with cytoplasmic division."];
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Interphase

- Phase between two successive M phases.
- Lasts for 95% of total duration of cell cycle.
- Also called resting phase but Cell prepare itself for division by undergoing both cell growth and DNA replication.

M phase (mitosis phase)

- The actual cell division or mitosis occurs
- Lasts for 5% of total duration of cell cycle
- Starts with nuclear division and ends with cytoplasmic division.

Interphase:

It is divided into 3 further phases G1, S, and G2.

G1 phase (Gap 1 Phase)

- Corresponds to interval between mitosis and initiation of DNA replication.
- The cell is metabolically active and continuously grows .

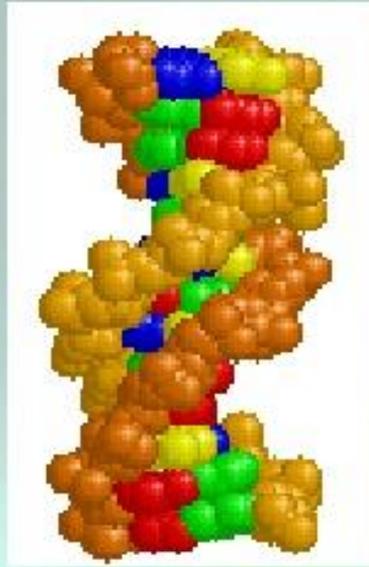
S phase (synthesis phase) :

- Period during which DNA synthesis or replication takes place.

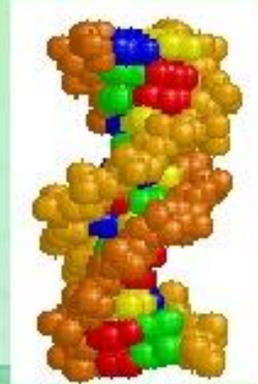
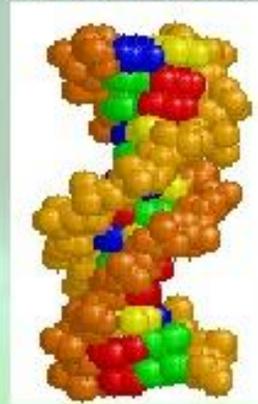
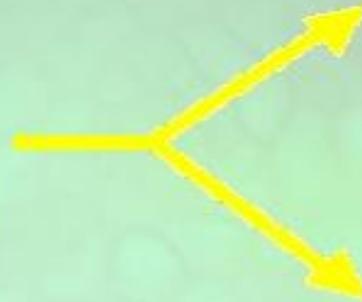
During this time the amount of DNA per cell doubles. (only amount of DNA is doubled, no of chromosomes remain same.)

Interphase - S Stage

- ✓ Synthesis stage
- ✓ DNA is copied or replicated



Original
DNA



Two
identical
copies
of DNA

In animal cells,

During the S phase, DNA replication begins in the nucleus, and the centriole duplicates in the cytoplasm.

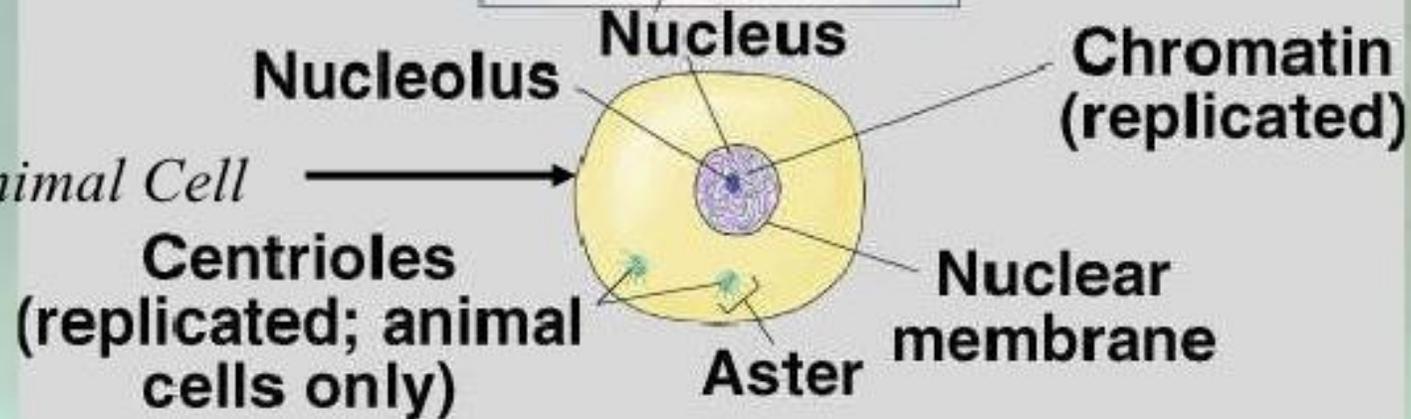
What's Happening in Interphase?

INTERPHASE (G₂)

What the cell looks like →



Animal Cell →



What's occurring →

- DNA replicates
- Centrioles, if present, replicate
- Cell prepares for division

G2 phase (Gap 2 Phase):

- Proteins are synthesized in preparation for mitosis .
- Cell growth continues.

G₀ or quiescent phase :

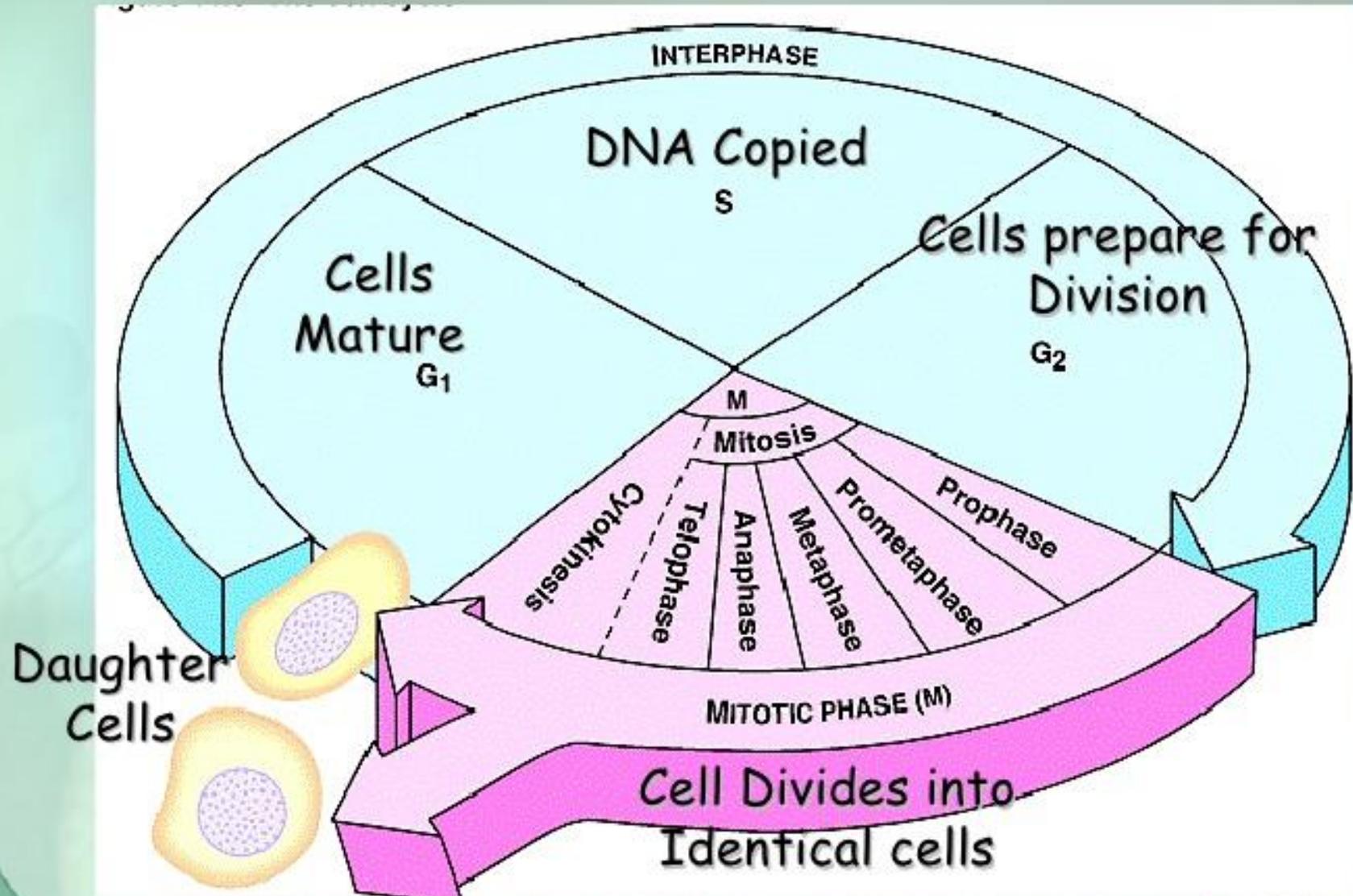
Some cells do not exhibit division like **heart cells, nerve cells etc.**

These cells enter in an inactive phase called **G₀ or quiescent phase** from **G1 phase**.

Quiescent stage (G 0) :

Cells at this stage remain metabolically active but do not proliferate unless called on to do so depending on the requirement of the organism..

Sketch the Cell Cycle



M PHASE

The number of chromosomes in the parent and progeny cells is the same. It is also called as **equational division.**

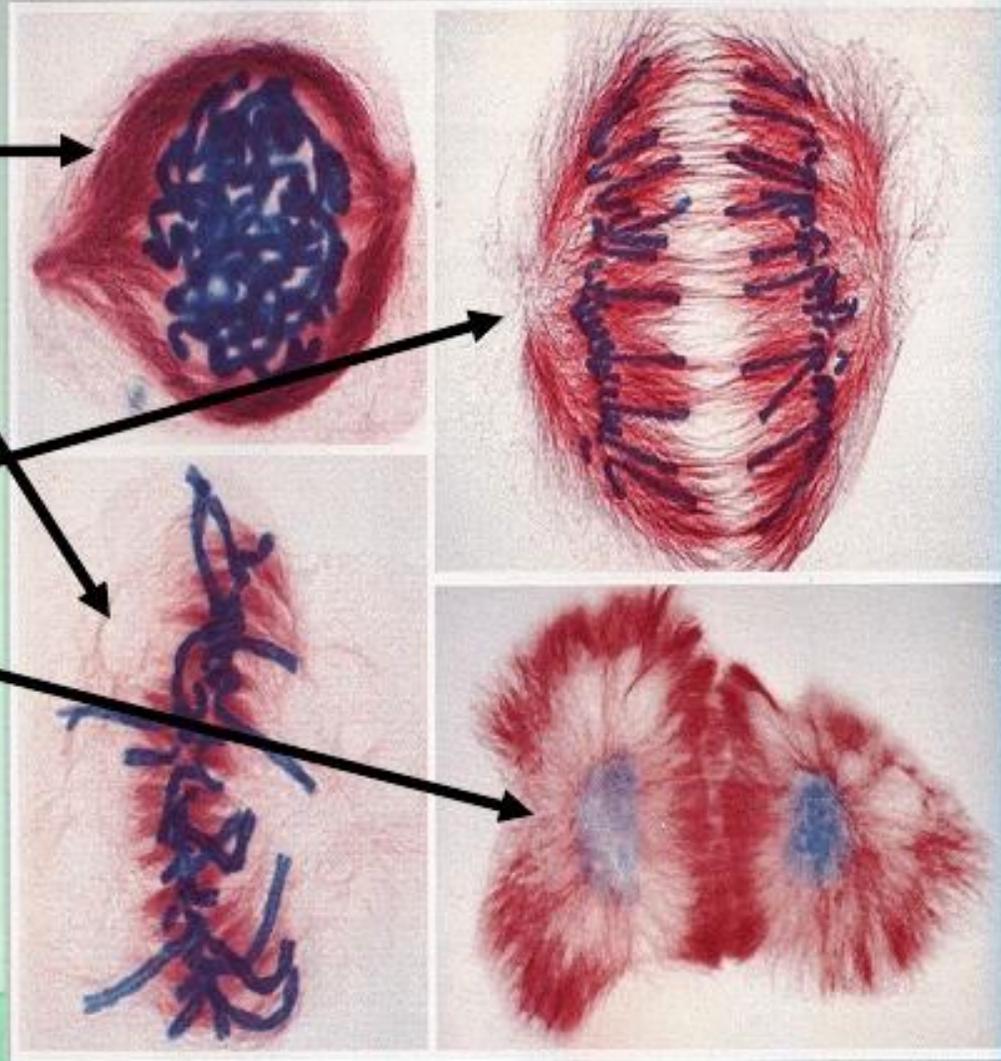
Four Mitotic Stages

✓ **Prophase**

✓ **Metaphase**

✓ **Anaphase**

✓ **Telophase**



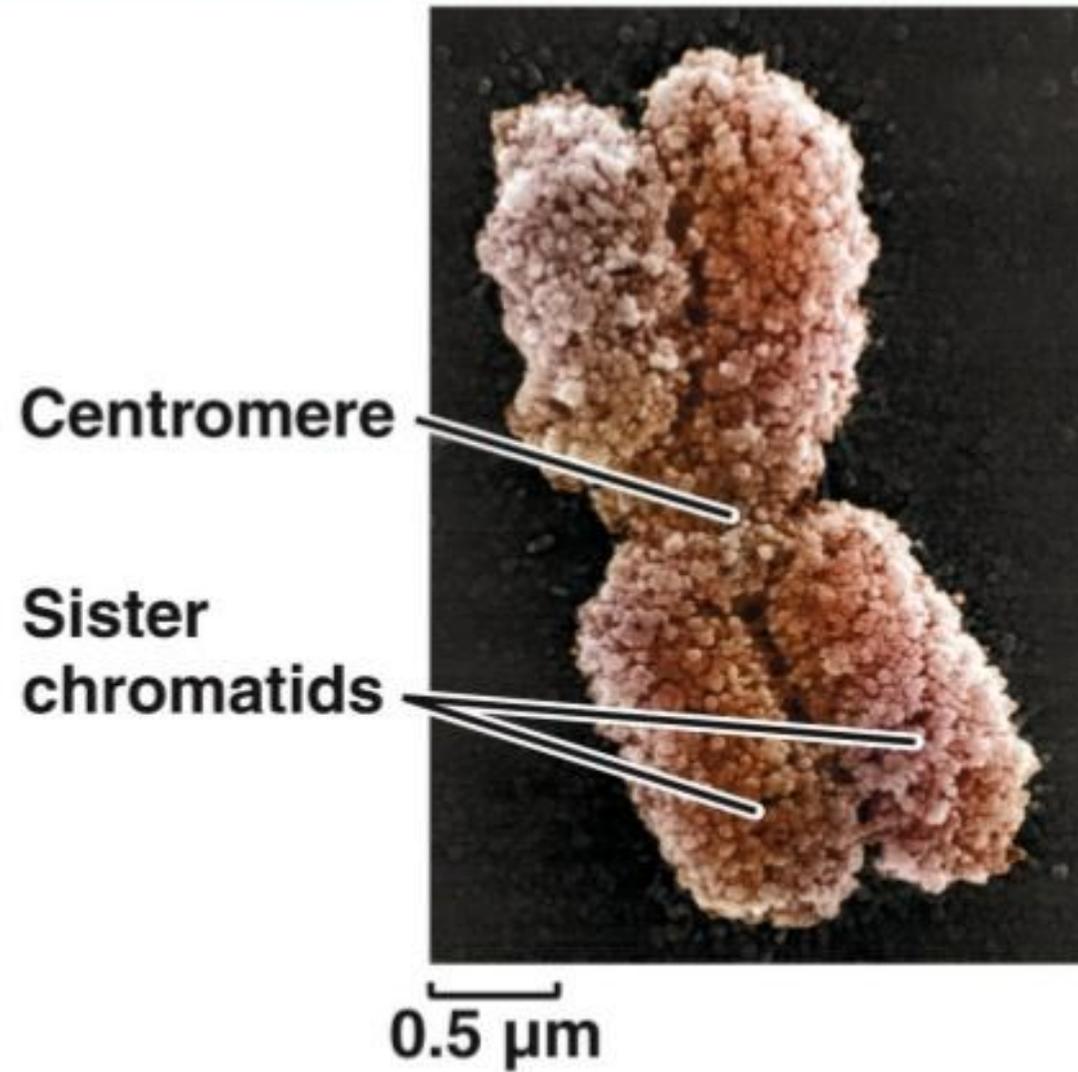
Prophase:

- Initiation of condensation of chromosomal material.
- The duplicated centriole, begins to move towards opposite poles of the cell.

The completion of prophase can thus be marked by the following characteristic events:

- Chromosomal material condenses to form compact mitotic chromosomes.
- Chromosomes are composed of two chromatids attached together at the centromere.
- Initiation of the assembly of mitotic spindle.

Figure 7.5 The Phases of the Eukaryotic Cell Cycle (Part 1)



Late Prophase

Chromosomes

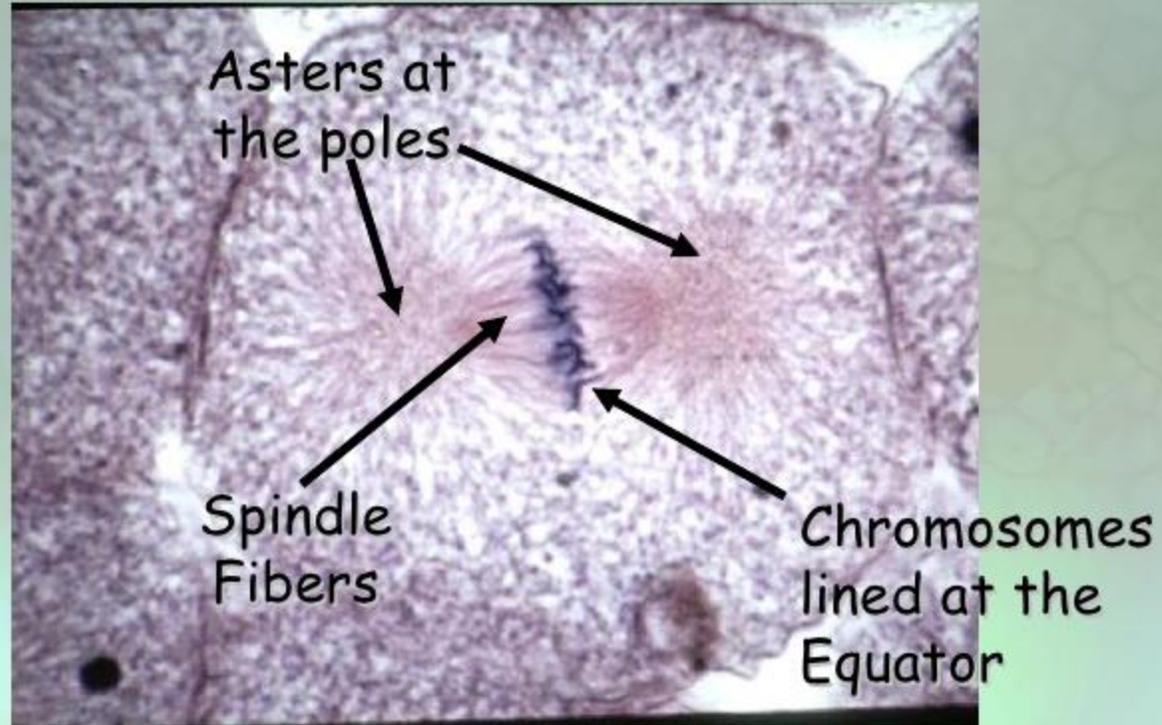


Nucleus & Nucleolus have disintegrated

Metaphase:

- Complete disintegration of the nuclear envelope.
- The chromosomes are spread through the cytoplasm of the cell.
- Condensation of chromosomes is completed

Metaphase



The key features of metaphase are:

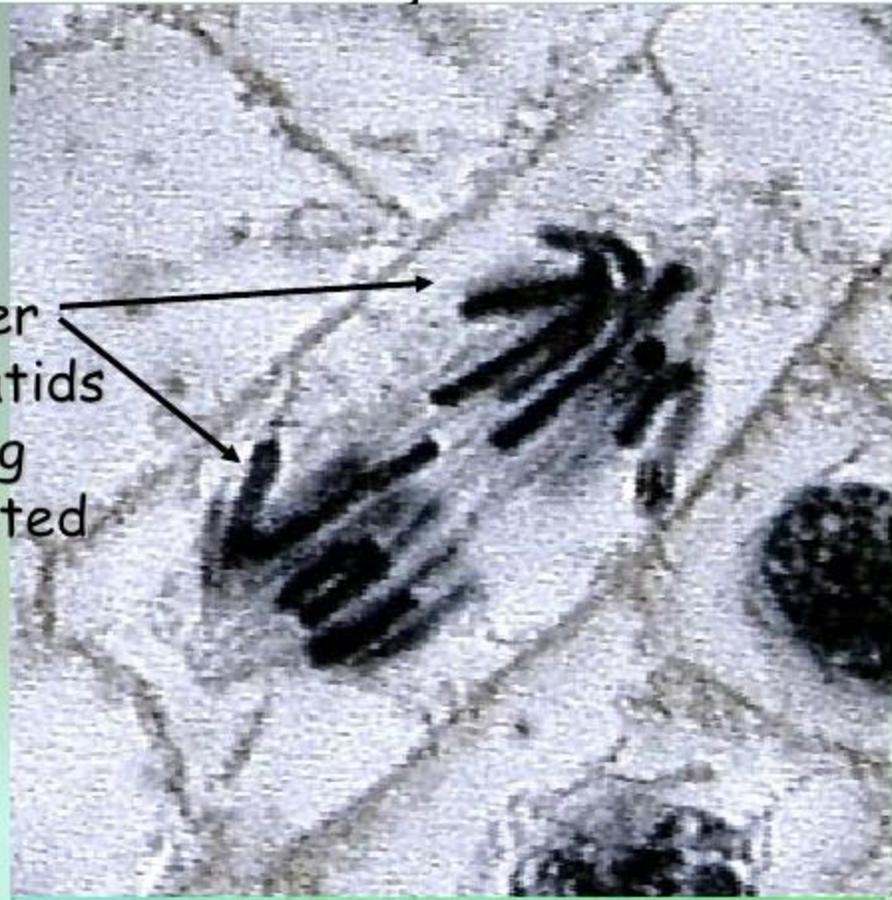
- Spindle fibres attach to kinetochores of chromosomes.
- Chromosomes are moved to spindle equator and get aligned along metaphase plate through spindle fibres to both poles.

Anaphase:

- Centromeres split and chromatids separate.
- Chromatids move to opposite poles.

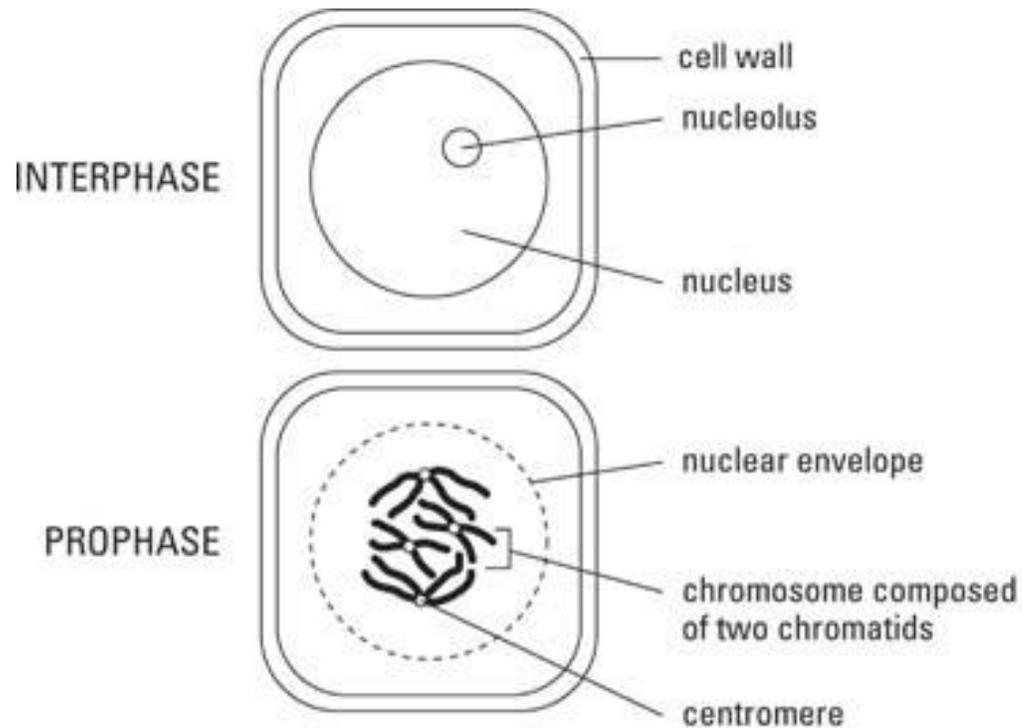
Anaphase

Sister
Chromatids
being
separated

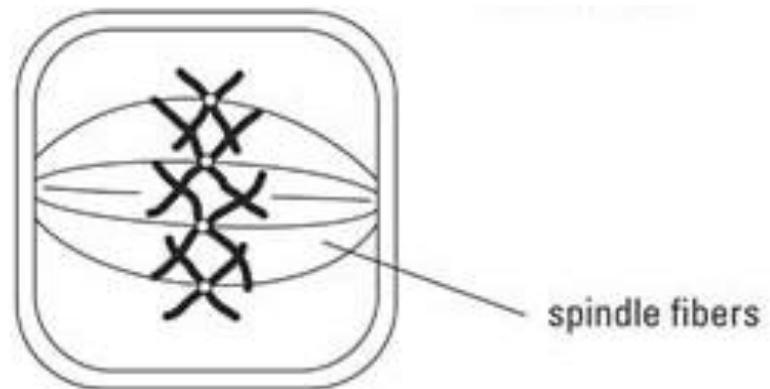


TELOPHASE :

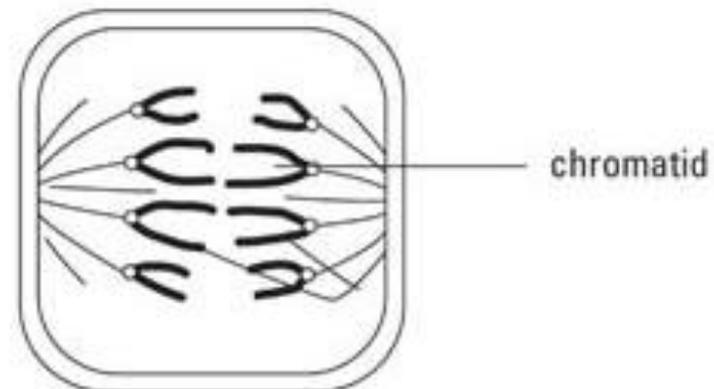
- Chromosomes cluster at opposite spindle poles and their identity is lost as discrete elements.
- Nuclear envelope assembles around the chromosome clusters.
- Nucleolus, golgi complex and ER reform.



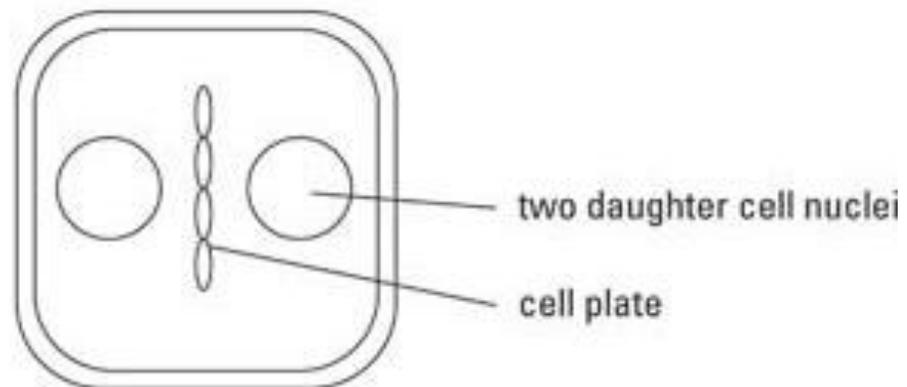
METAPHASE



ANAPHASE



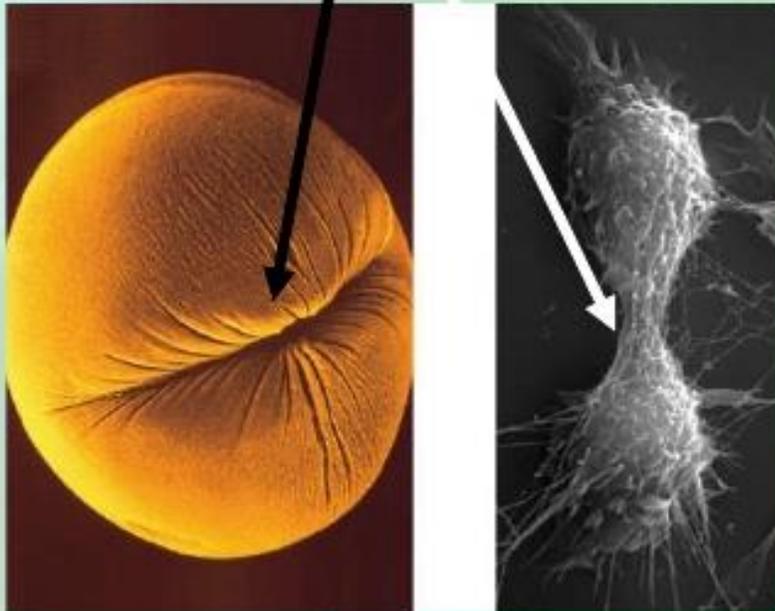
TELOPHASE



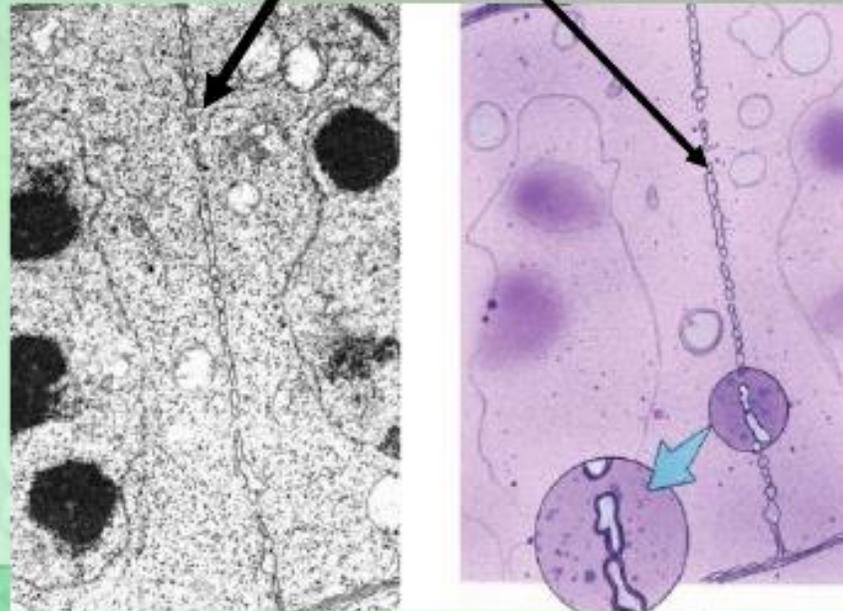
MITOSIS

Cytokinesis

Cleavage furrow
in animal cell



Cell plate in plant
cell



Cytokinesis :

It is the division of protoplast of a cell into two daughter cells after Karyokinesis (nuclear division).

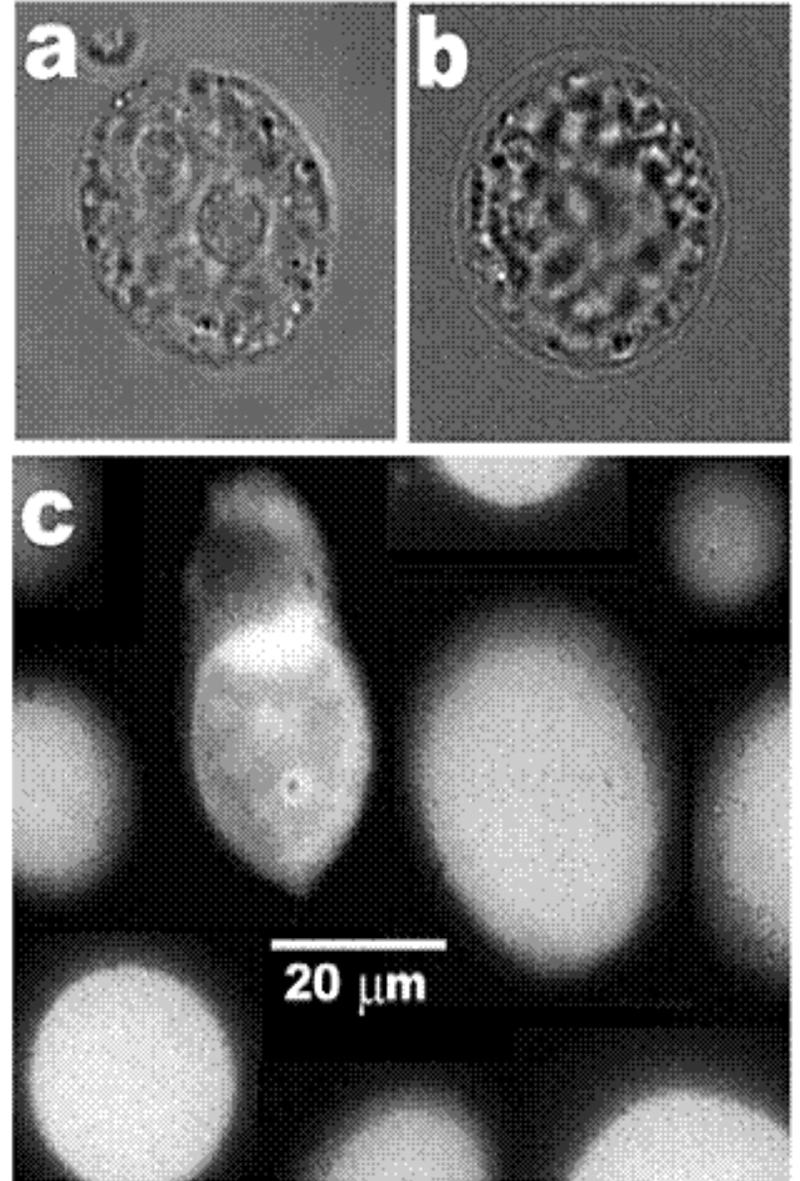
Animal cytokinesis : Appearance of furrow in plasma membrane which deepens and joins in the centre dividing cell cytoplasm into two.

Plant cytokinesis :

Formation of new cell wall begins with the formation of a simple precursor – cell plate which represents the middle lamella between the walls of two adjacent cells.

In some organisms karyokinesis is not followed by cytokinesis - result in multinucleate condition arises leading to the formation of syncytium e.g., **liquid endosperm in coconut.**

Coconut Syncytial Nuclei



Significance of Mitosis:

- Mitosis results in the production of diploid daughter cells with identical genetic material.
- The growth of multicellular organisms is due to mitosis.
- Cell growth results in disturbing the ratio between the nucleus and the cytoplasm. Therefore, cell divide to restore the nucleo-cytoplasmic ratio.

- Mitosis is important in cell repair.
- The cells of the upper layer of the epidermis, cells of the lining of the gut, and blood cells are constantly replaced.
- Mitotic divisions in meristematic tissues – the apical and the lateral cambium, result in continuous growth of plants throughout their life.

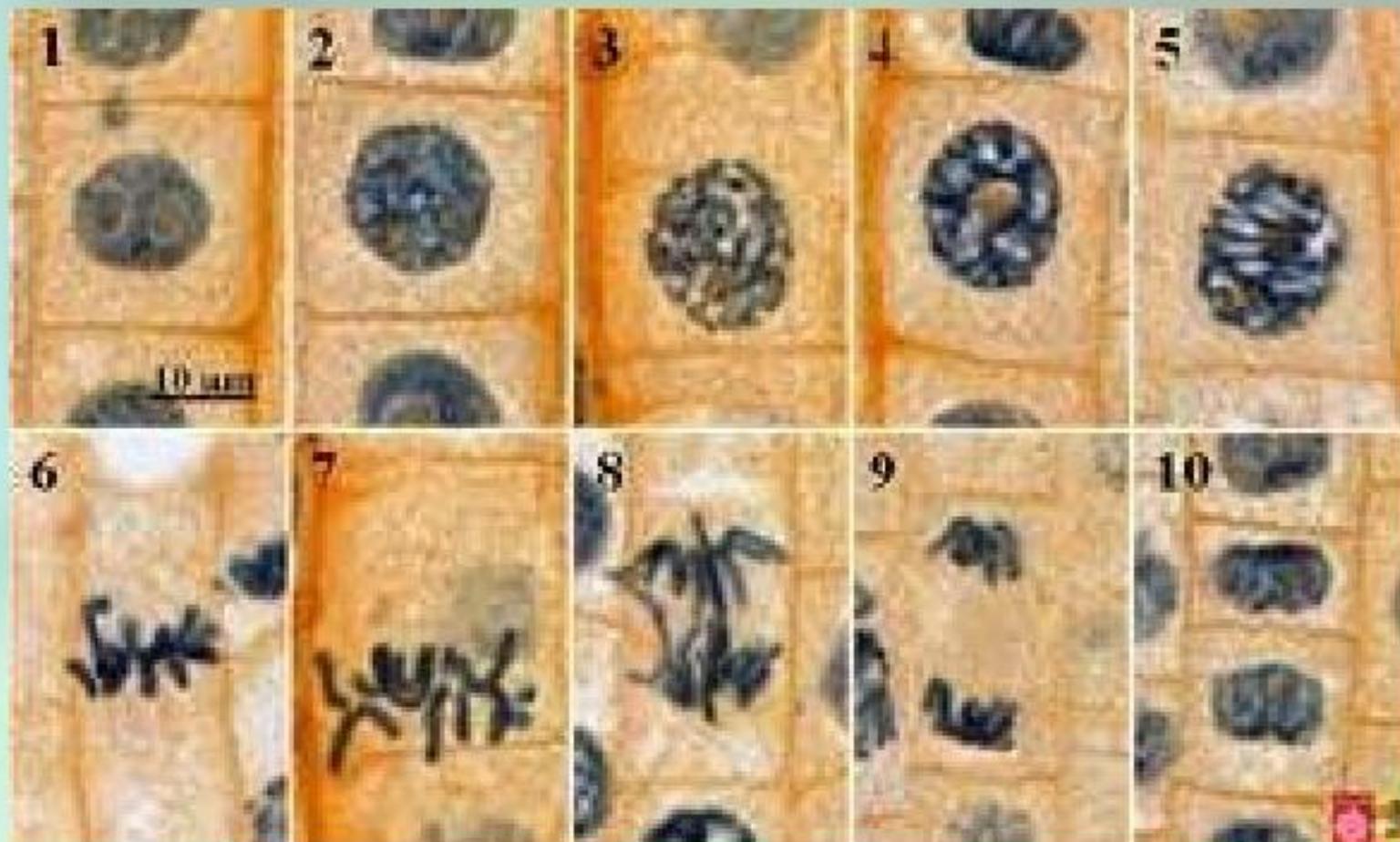
https://www.youtube.com/watch?v=L61Gp_d7evo

<https://www.youtube.com/watch?v=DwAFZb8juMQ>

Test Yourself over Mitosis

Mitosis in Onion Root Tips

Do you see any stages of mitosis?



Question and answers :

1. Why is mitosis called equational division?
2. Name the stage of cell cycle at which one of the following events occur:
 - (i) Chromosomes are moved to spindle equator.
 - (ii) Centromere splits and chromatids separate.
 - (iii) Chromosomes are set free in the cytoplasm
 - (iv) Spindle fiber get attached to centromere of the chromosome
3. How does cytokinesis in plant cells differ from that in animal cells?
4. Two events occur during S – phase in animal cells. DNA replication and duplication of centriole. In which parts of the cell do events occur?