



# Mitosis division in Onion Root Tip Cells

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# Outline

- Mitosis
- Phases of Mitosis
- Why use onion roots for viewing mitosis
- Materials and Equipment
- Procedure



## ■ Objectives

- By examining the onion root tip cells under a microscope, the experiment aims to identify and distinguish the different stages of mitosis, including the characteristics of each stage.



## ■ Mitosis:

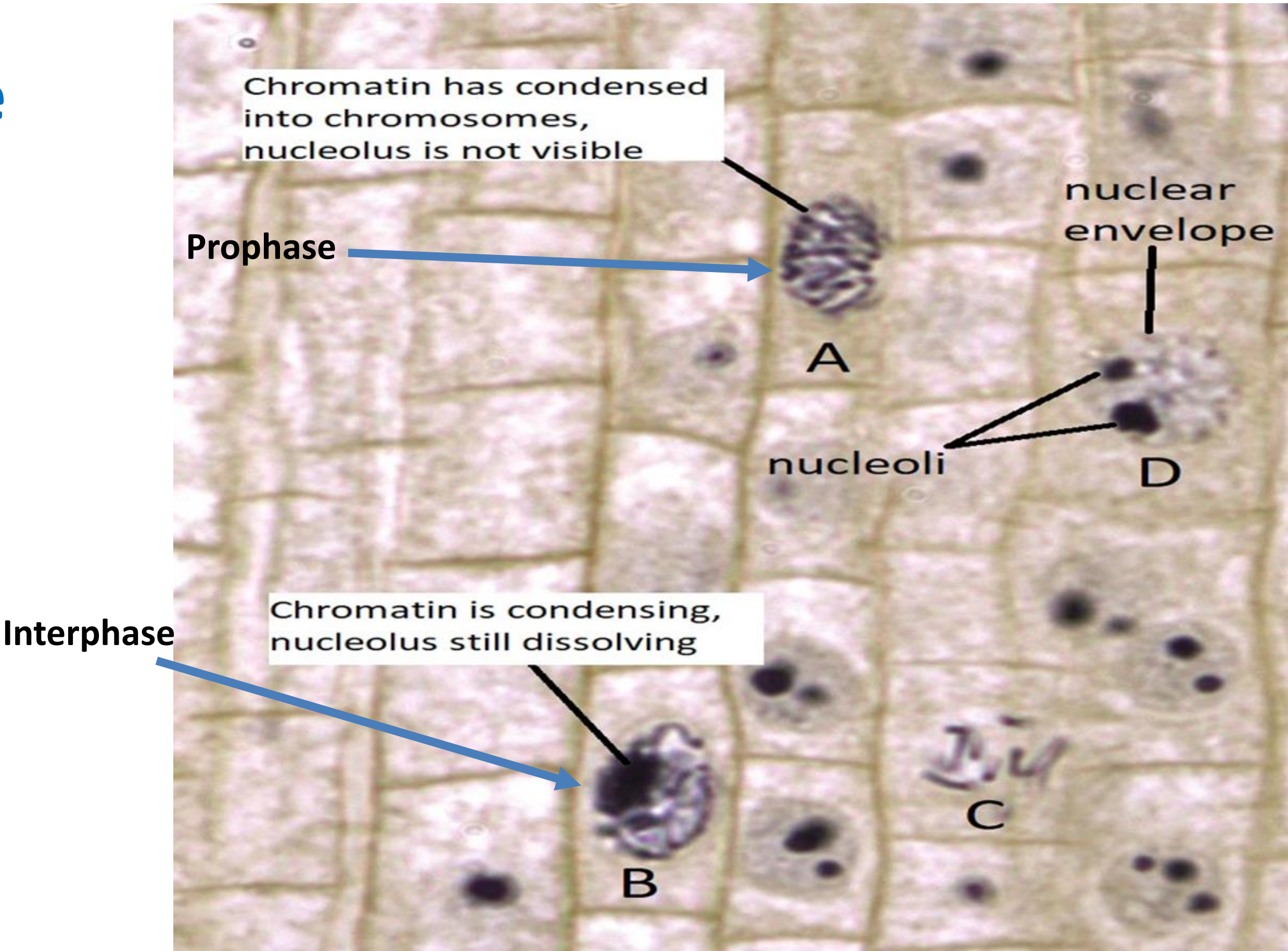
- Is a fundamental process of cell division that allows a single cell to produce **two genetically identical daughter cells**.
- **It plays a crucial role in growth, repair, and asexual reproduction in organisms.**
- The study of mitosis is often conducted using the root tips of plants like onions because they contain **actively dividing cells**.



## ■ Phases of Mitosis:

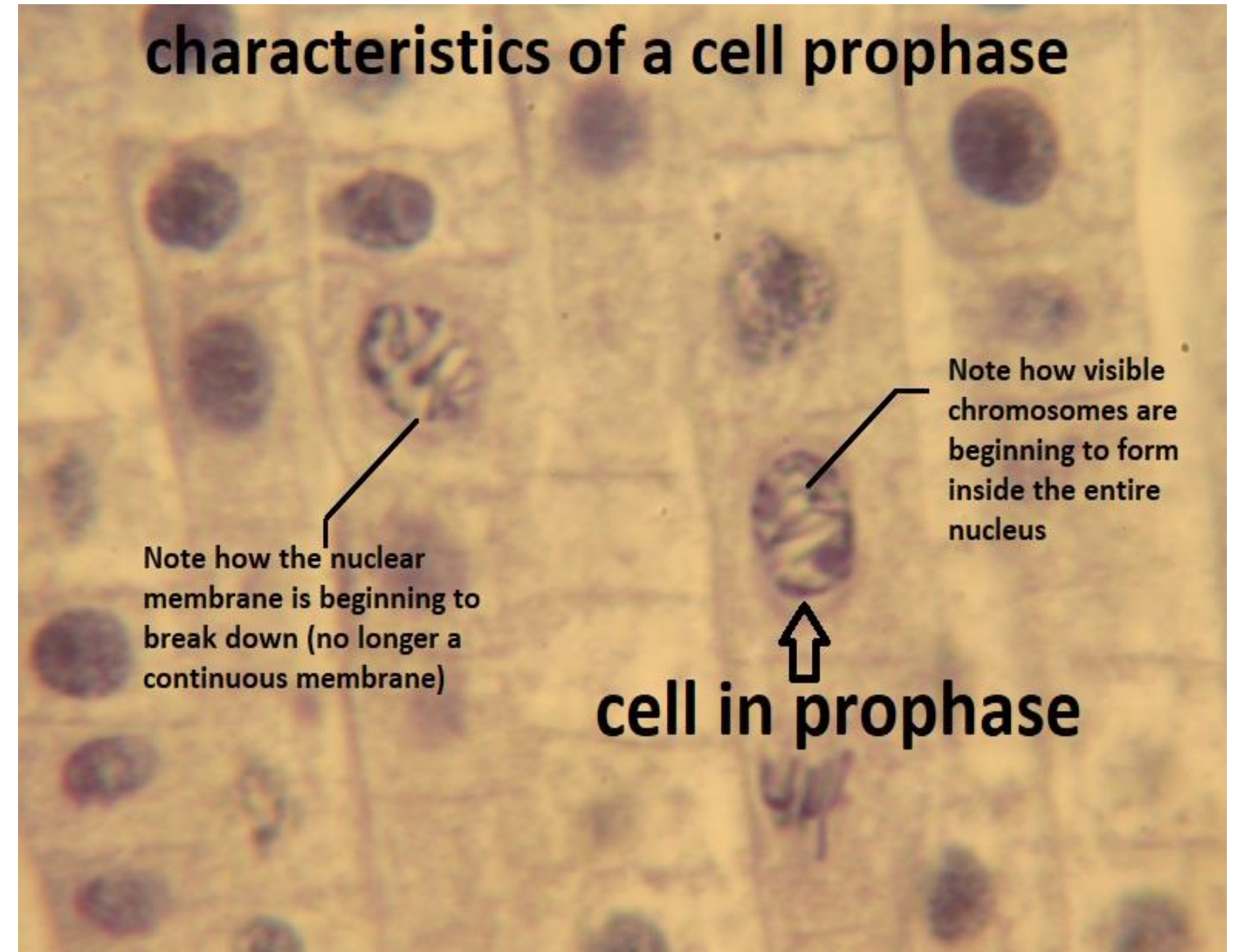
- The microscope reveals cells in various stages of mitosis.
- ✓ These stages include:
  - Interphase
  - Prophase
  - Metaphase
  - Anaphase
  - Telophase.

■ **Interphase**



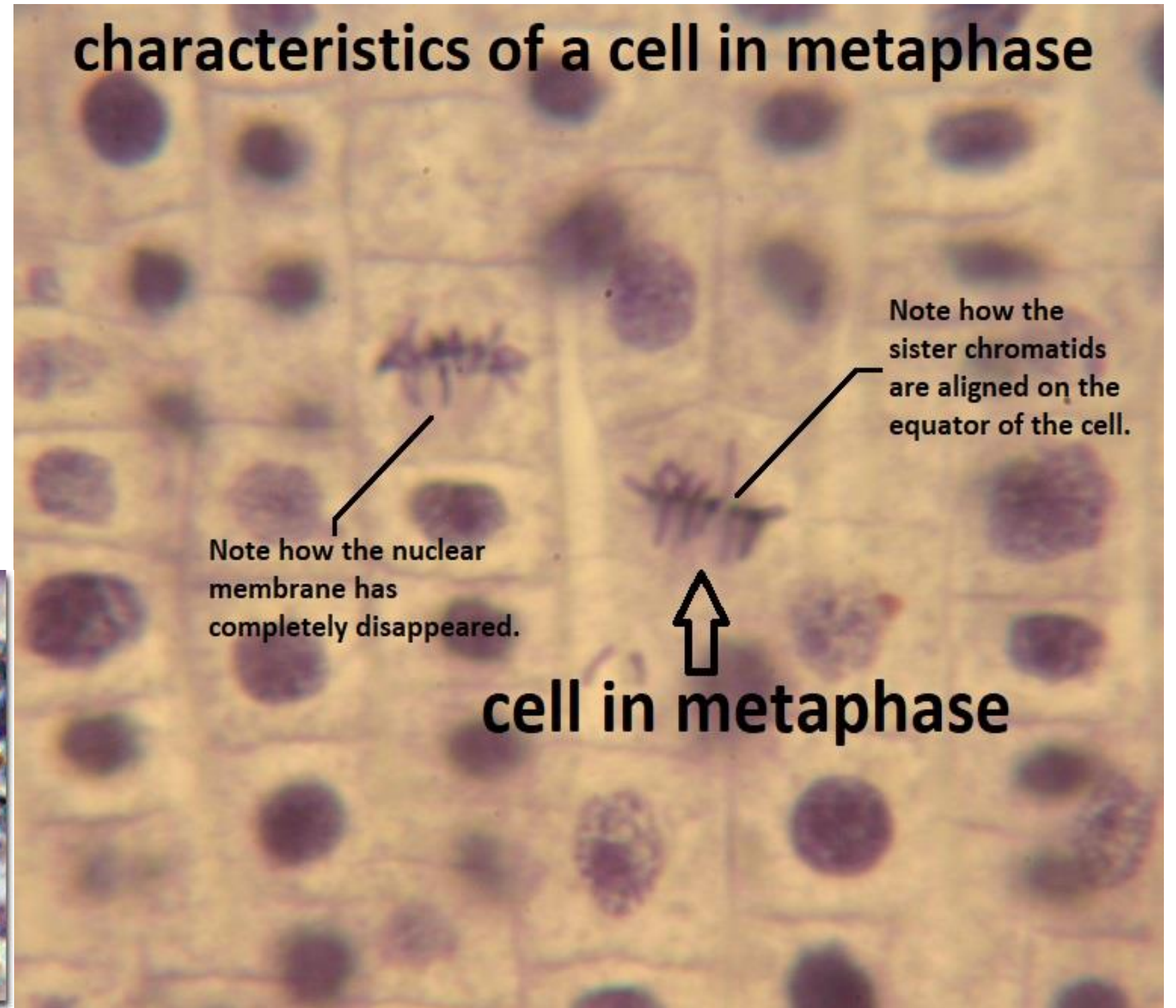
## ■ Prophase:

- The chromosomes supercoil and the fibers of the spindle apparatus begin to form between centrosomes located at the pole of the cells.
- The nuclear membrane also disintegrates at this time, freeing the chromosomes into the surrounding cytoplasm.



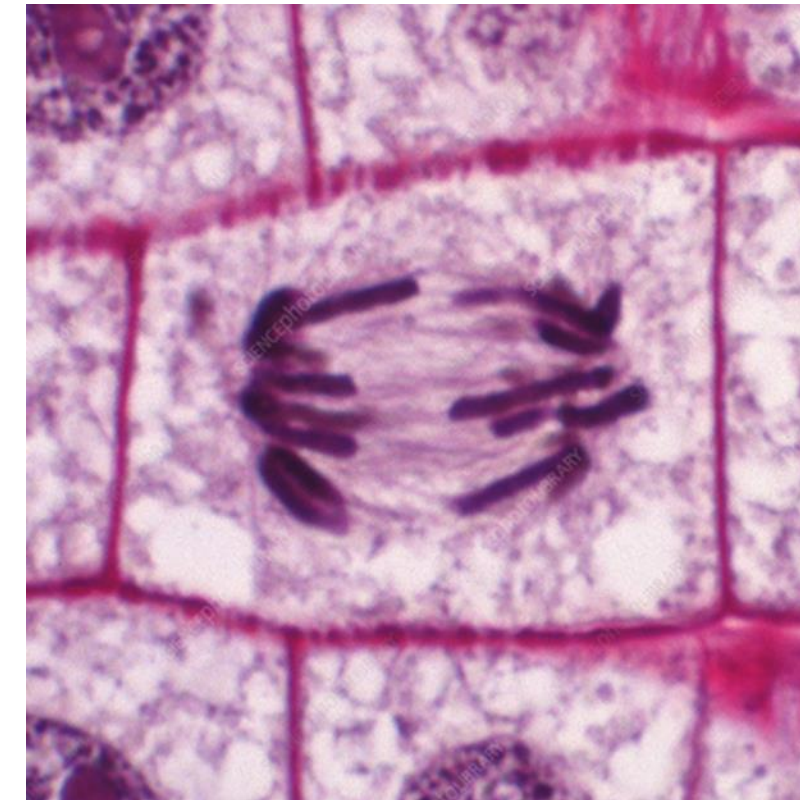
## ■ **Metaphase:**

- The chromosomes align at the cell's equatorial plane, known as the metaphase plate.
- Spindle fibers attach to the centromeres of the chromosomes.



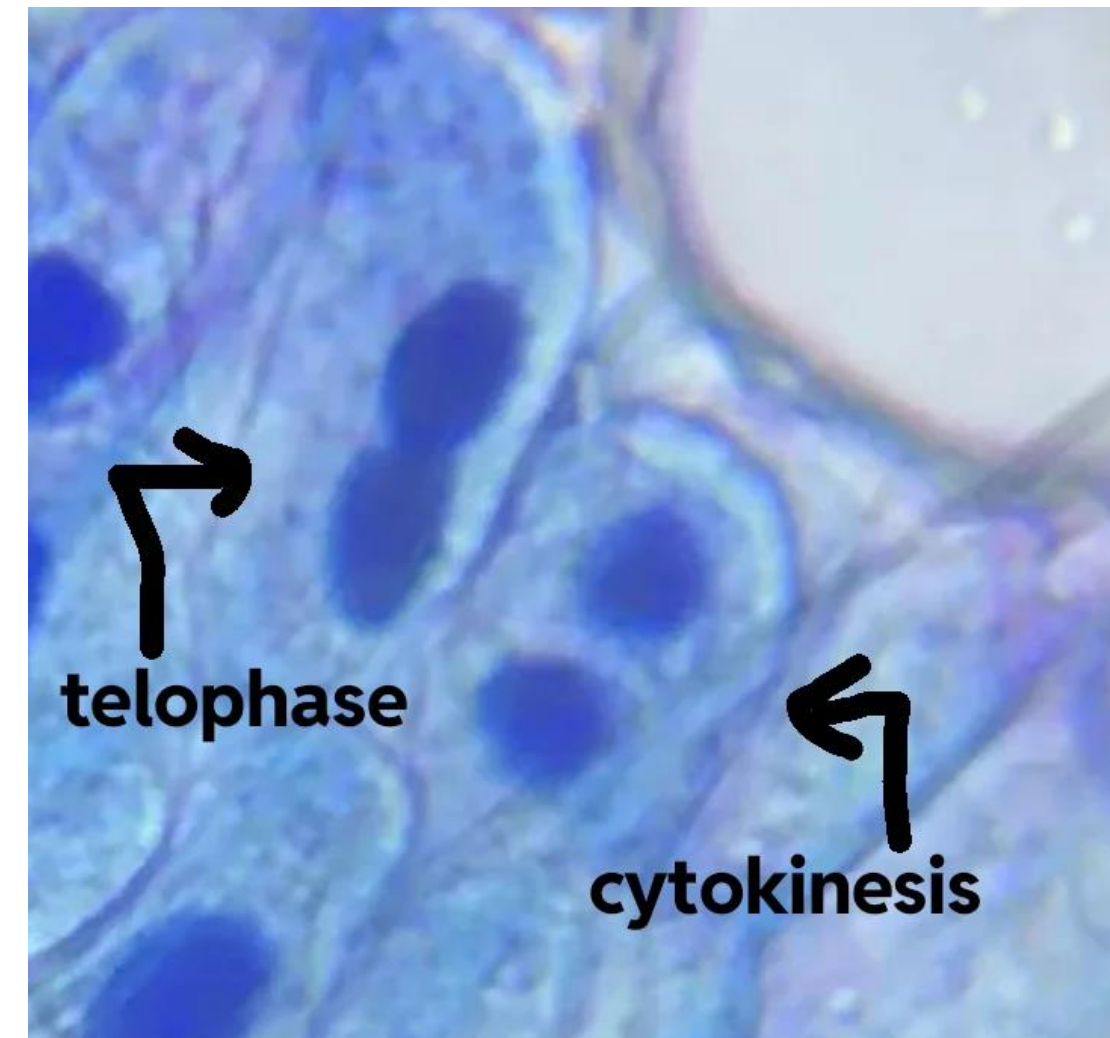


- **Anaphase:**
  - Is marked by the separation of sister chromatids.
  - Spindle fibers shorten, pulling the chromatids toward opposite poles of the cell.



## ■ Telophase:

- Telophase sees the reformation of nuclear envelopes around the separated chromatids, which are now considered individual chromosomes.
- Cytokinesis, the division of the cytoplasm, also begins during this phase.
- **Cytokinesis:**
  - After mitosis is complete, cytokinesis occurs.
  - In plant cells, a structure called the cell plate forms between the two daughter cells and eventually becomes the cell wall that divides them.



## ▪ Viewing mitosis in onion root tips?

### ✓ Why use onion roots for viewing mitosis?

- Active Cell Division
- Clear and Visible Chromosomes
- The roots are easy to grow in large numbers
- The tips can be prepared in a way that allows them to be flattened on microscope slide
- The chromosomes can be stained to make them more easily observable





- There are typically three distinct cellular regions:

- ✓ Root Cap:

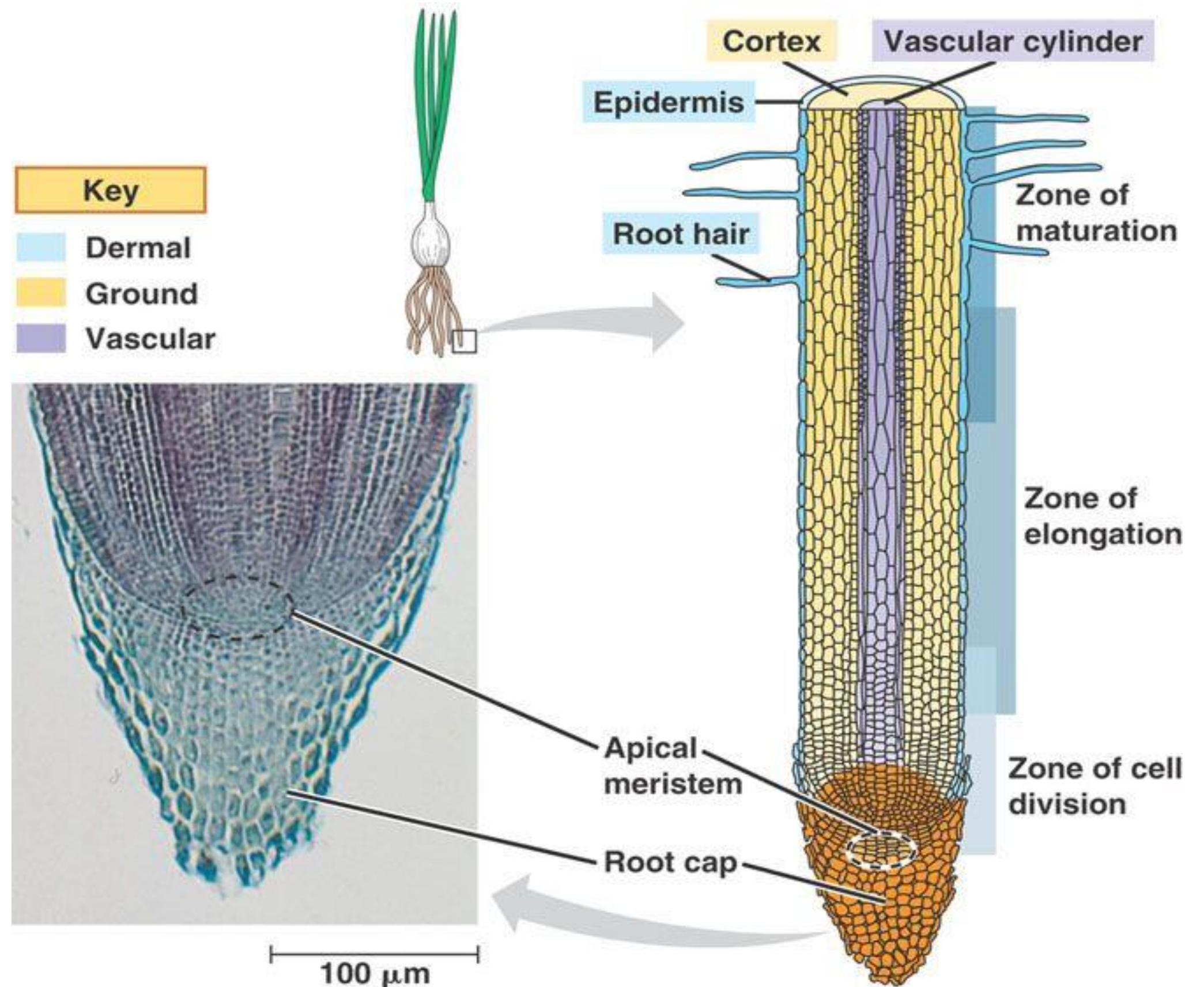
- The root cap is the outermost region and covers and protects the growing tip of the root.

- ✓ Meristem:

- Just behind the root cap, you'll find the meristem, which is the region of active cell division.

## ■ Elongation Zone:

- Following the meristem, there is the elongation zone
- Where the newly formed cells from the meristem region begin to elongate, increasing the length of the root.





# Viewing Chromosomes

- ❖ Chromosomes generally are not visible as distinct entities in non-dividing cells,
- ❖ Since the DNA is uncoiled, but the process of mitosis is facilitated by supercoiling of the chromosomes into a highly compacted form.
- ❖ Supercoiled chromosomes can be visualized in cells, particularly if they are treated with a **DNA-specific stain**, such as the **Feulgen stain**.



# Materials and Equipment

- Compound microscope
- **Acetocarmine stain**
- Water
- Burner
- N/10 Hydrochloric acid
- Filter paper
- Coverslip
- Glass Slide
- Onion root peel
- Forceps
- Blade
- Watch glass
- Dropper
- Needle

# Procedure of The Experiment

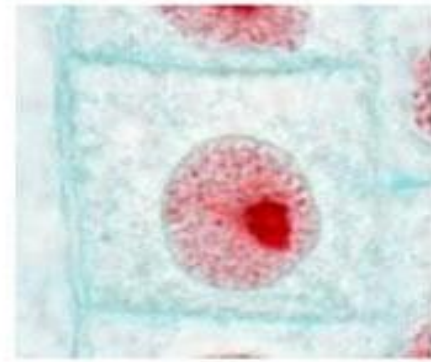
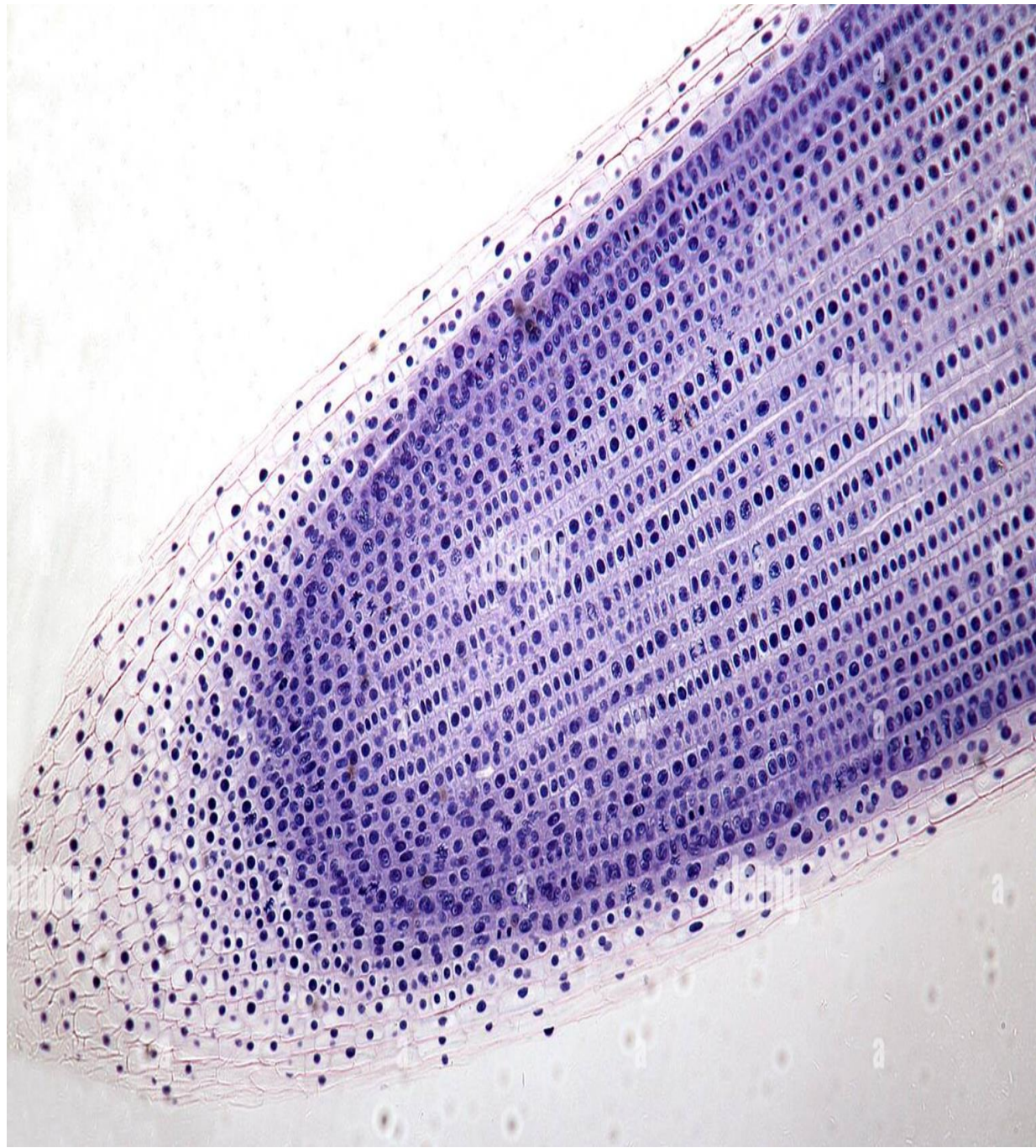
- Place an onion on a tile
- With the help of a sharp blade, carefully snip the dry roots of the onion
- Place the bulbs in a beaker containing water to grow the root tips
- It may take around 4 to 6 days for the new roots to grow and appear
- Trim around **3 cm** of the newly grown roots and place them in a watch glass
- With the help of forceps, shift it to a vial holding freshly prepared **aceto- alcohol** i.e., a **mixture of glacial acetic acid and ethanol in the ratio 1:3**
- Allow the root tips to remain in the vial for one complete day
- With the help of forceps, pick one root and set in on a new glass slide
- With the help of a dropper, allow one drop of N/10 **HCl** to come in contact with the tip of the root. Additionally, add around 2 to 3 drops of the **acetocarmine stain**



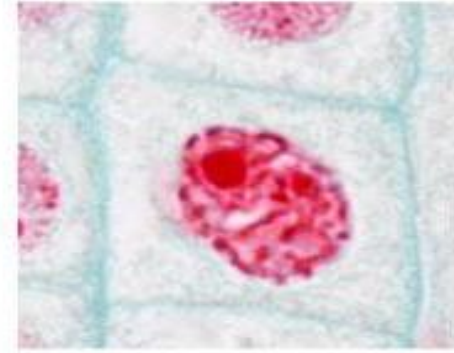
# Procedure

- Heat it lightly on the burner in such a way that the stain does not dry up
- Excessive stain can be carefully treated using filter paper
- The more stained part of the root tip can be trimmed with the help of a blade.
- Discard the lesser stained part while retaining the more stained section
- Add a droplet of water to it with the help of a needle, a coverslip can be mounted on it
- Gently tap the coverslip with an unsharpened end of a needle in order for the meristematic tissue of the root tip present under the coverslip to be squashed properly and to be straightened out as a fine cell layer
- The onion root tip cells' slide is now prepared and ready to be examined for different stages of mitosis
- Observe and study mitosis by placing the slide under the compound microscope. Focus as desired to obtain a distinct and clear image

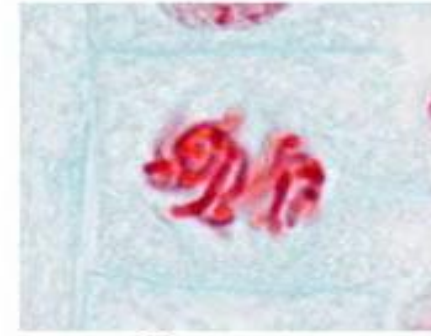
# Mitosis - *Allium* Root Tip



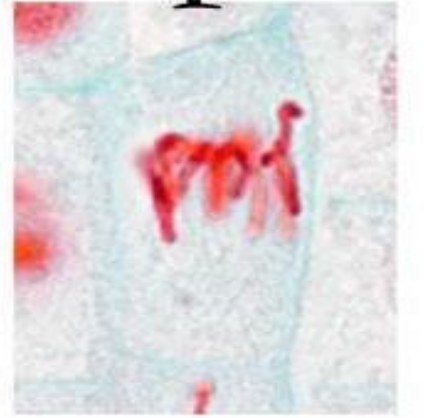
Interpahase



Prophase



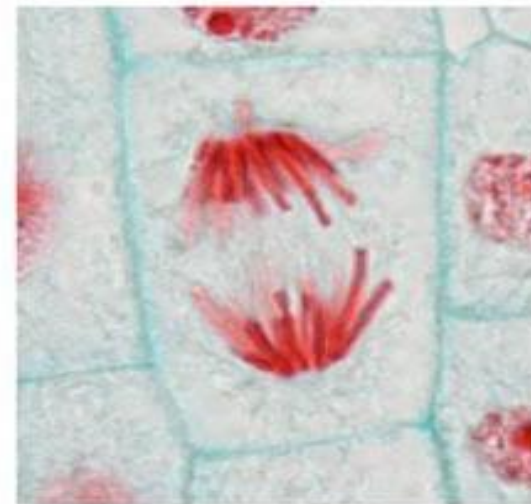
Later  
Phrophase



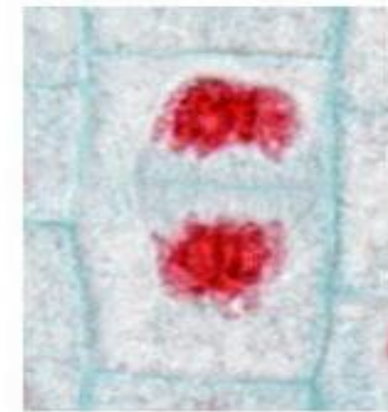
Metaphase



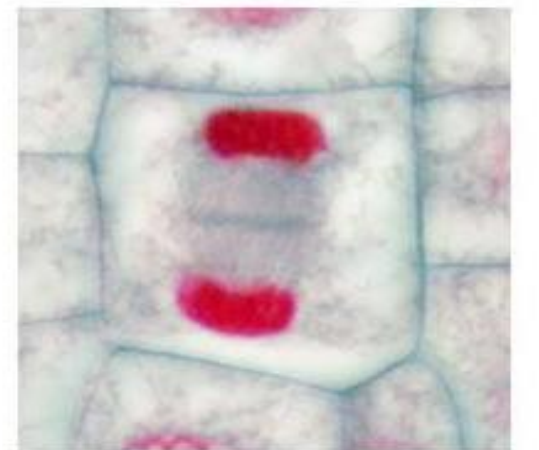
Early Anaphase



Anaphase

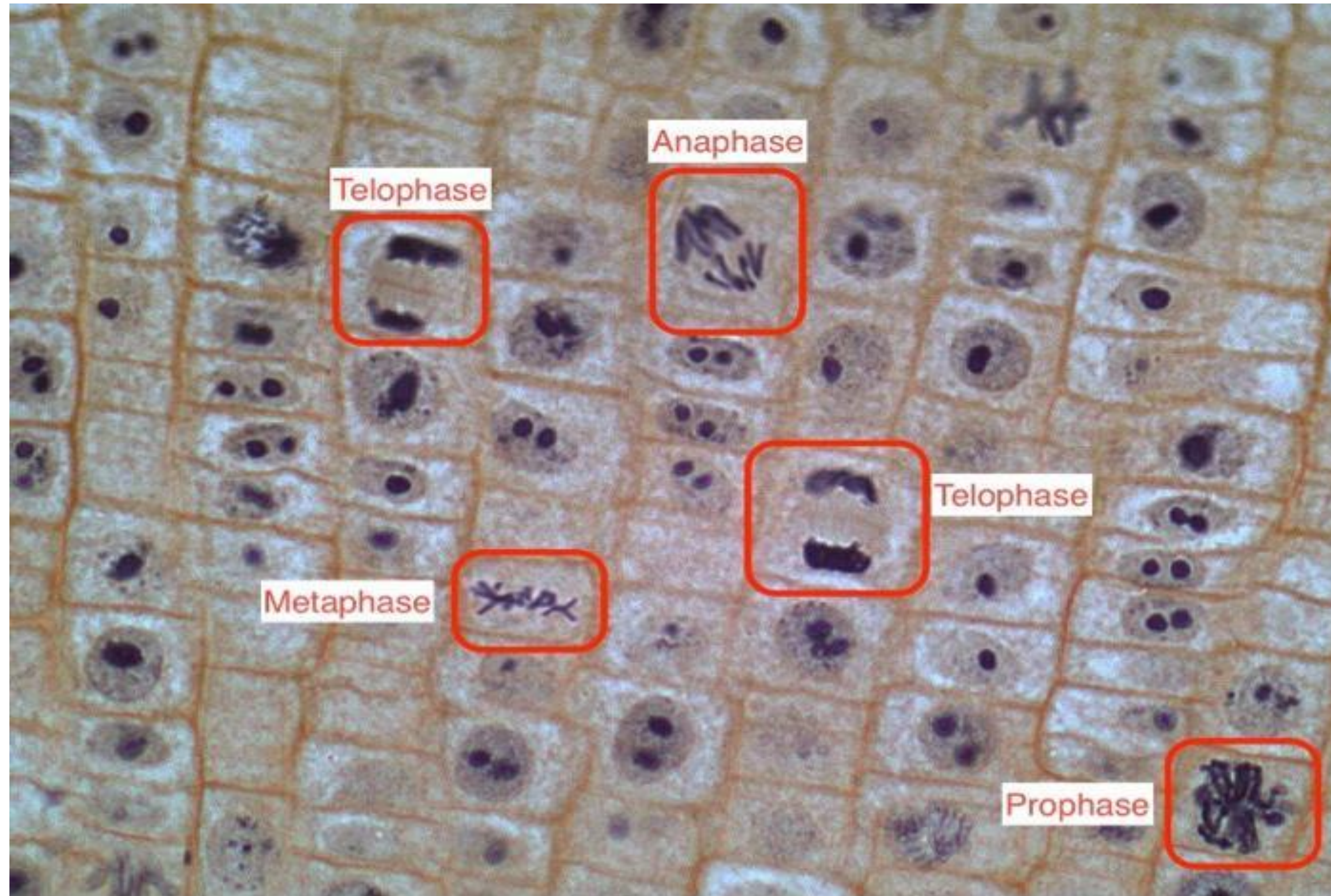


Telophase



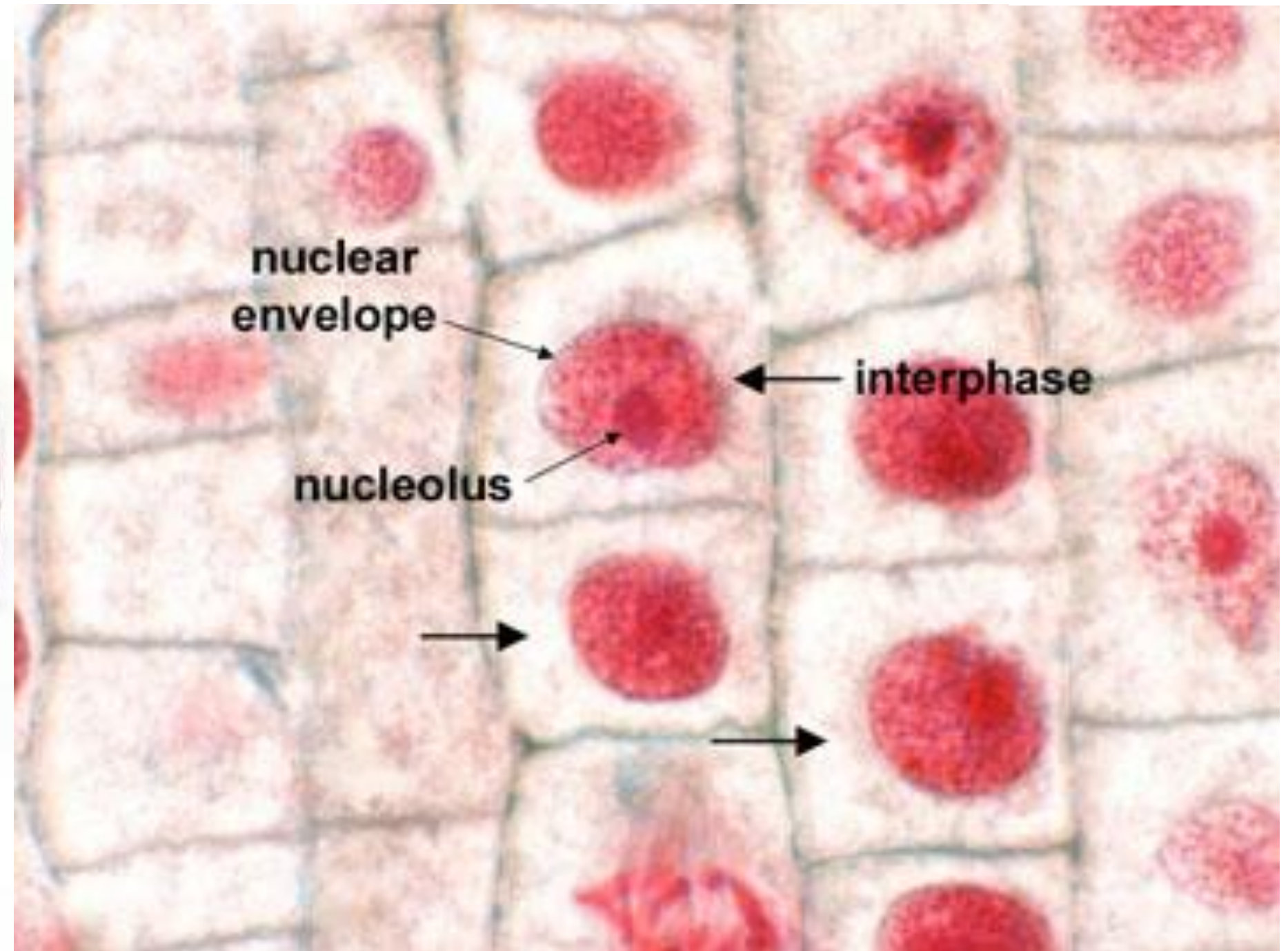
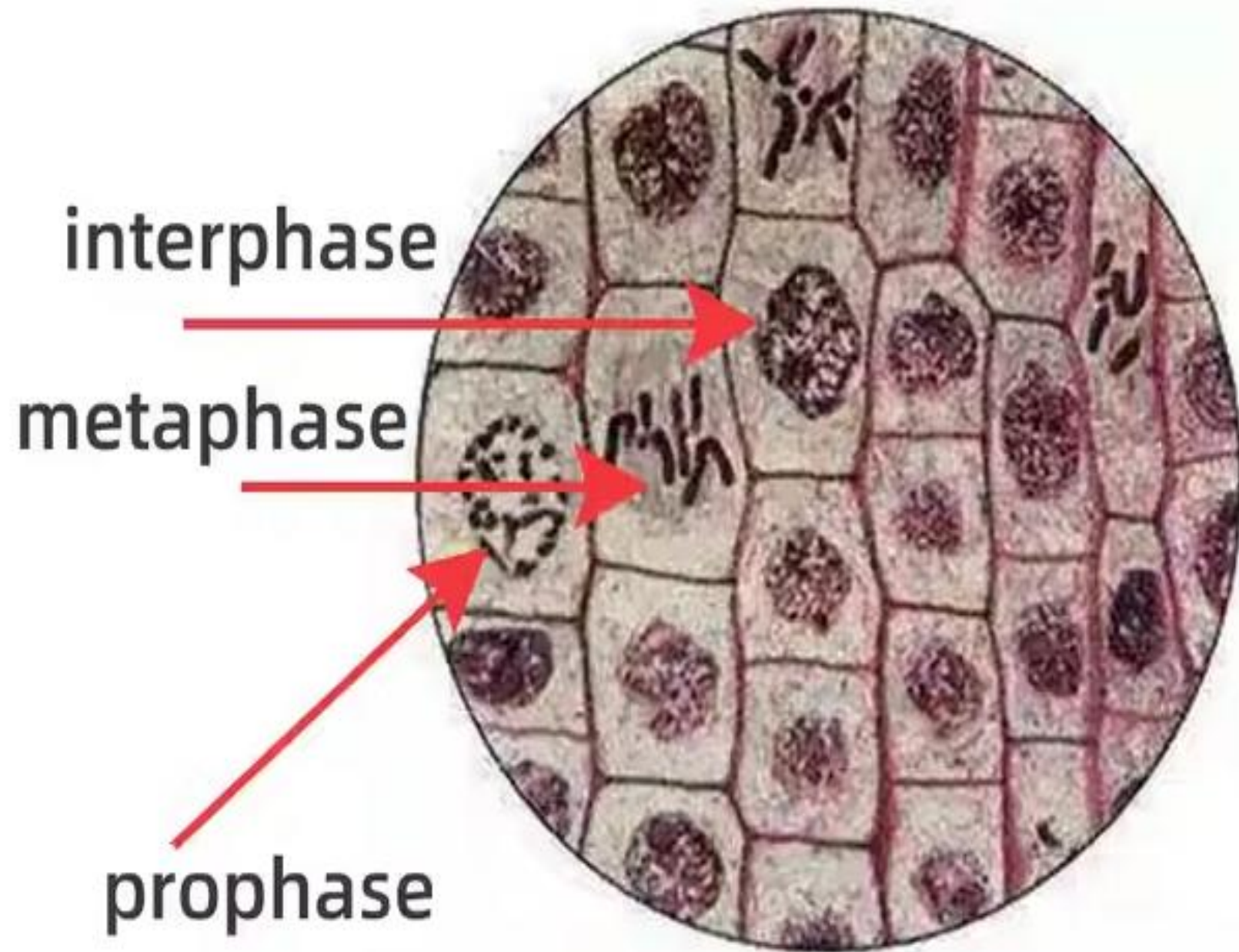
Later Telophase

# Mitosis Division

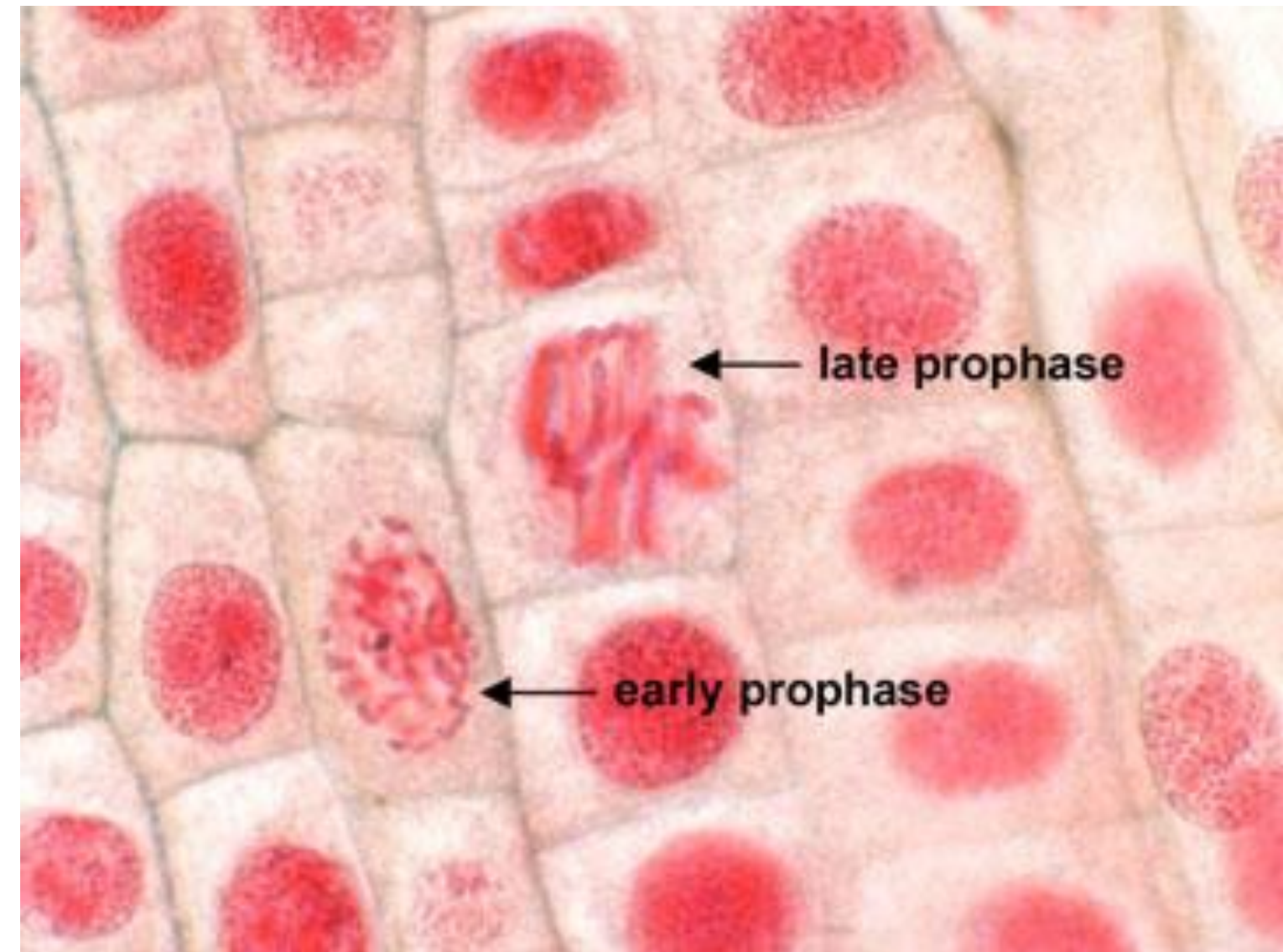


# ■ Observations of onion root tip squash:

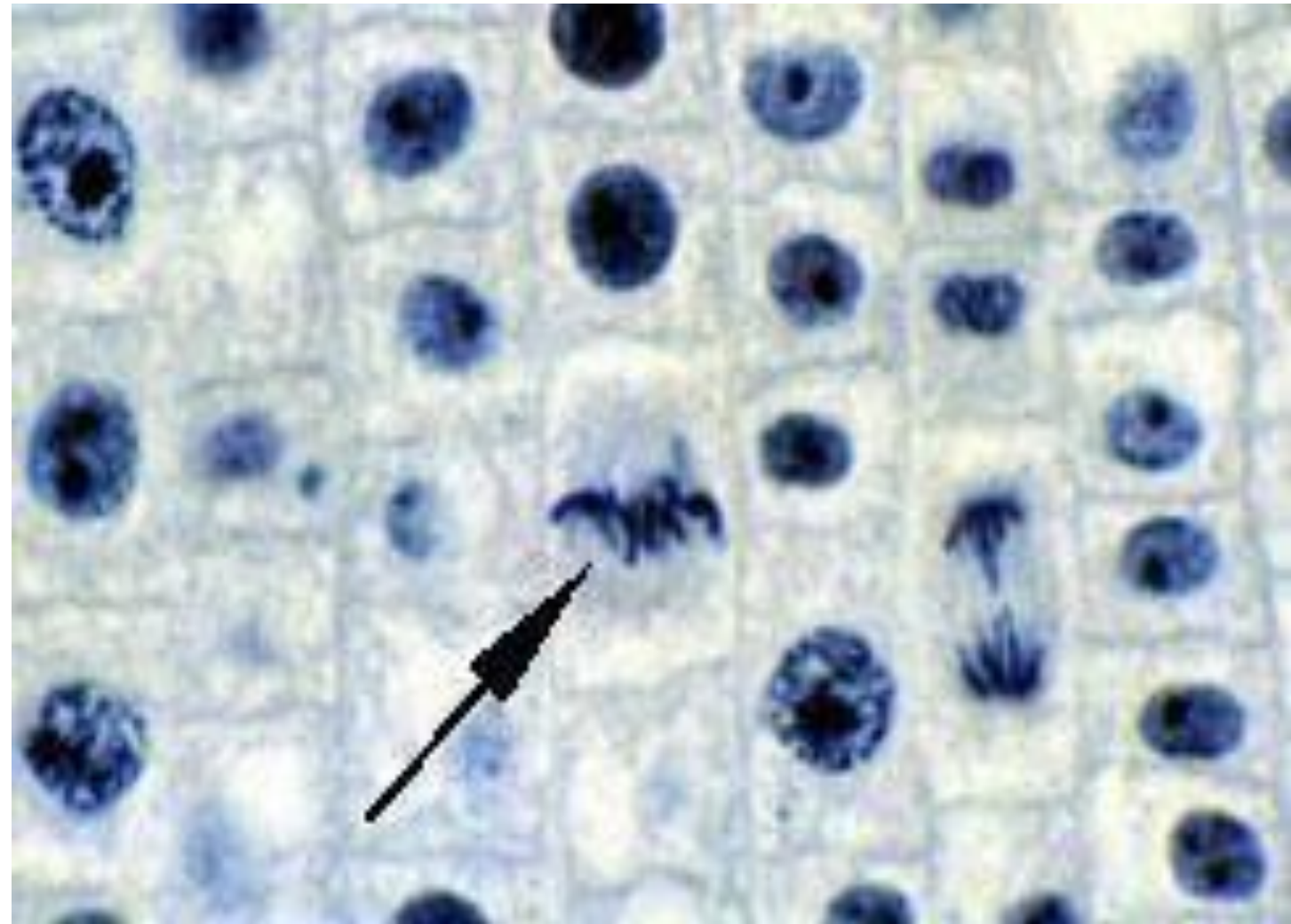
## • Interphase



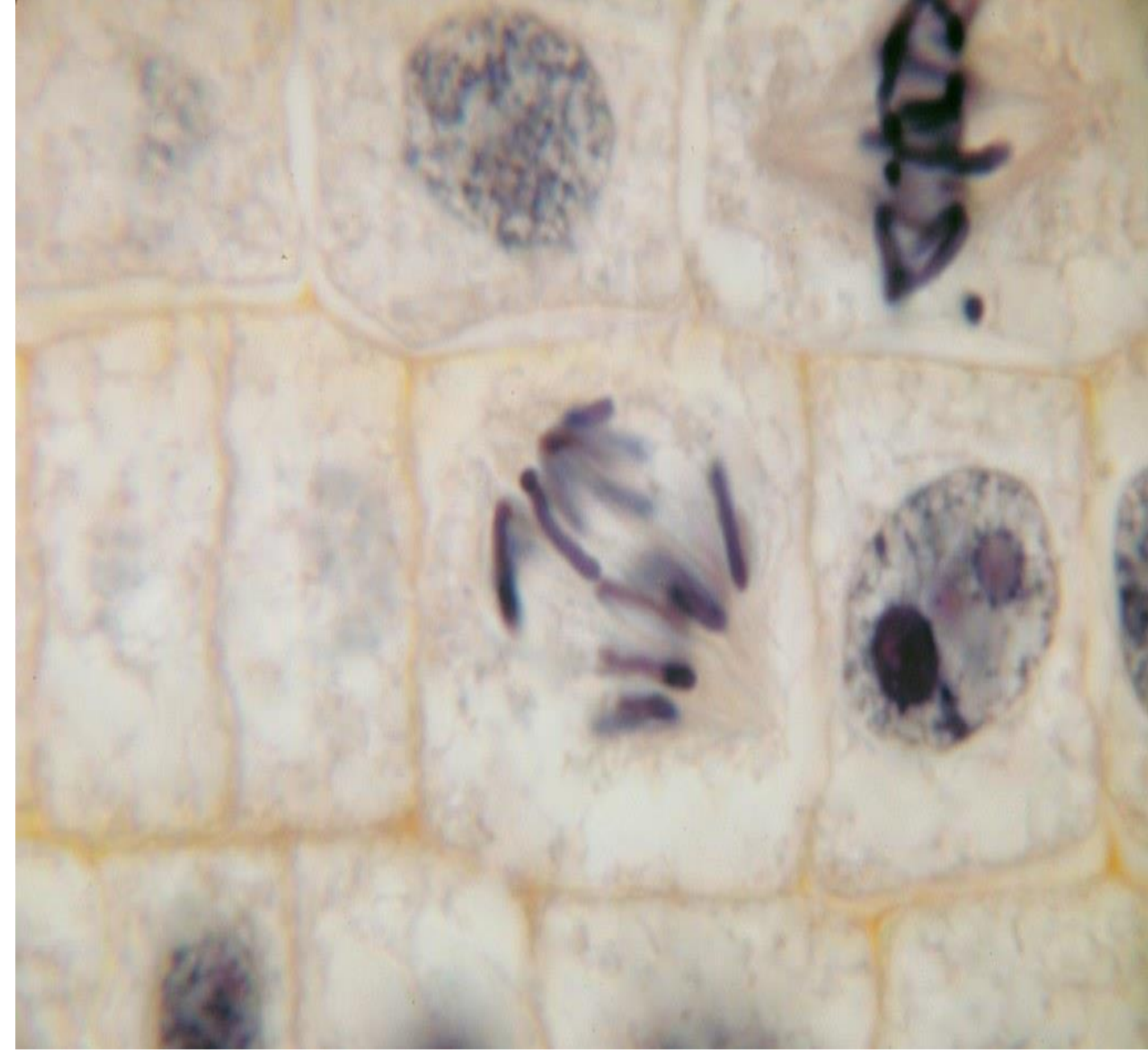
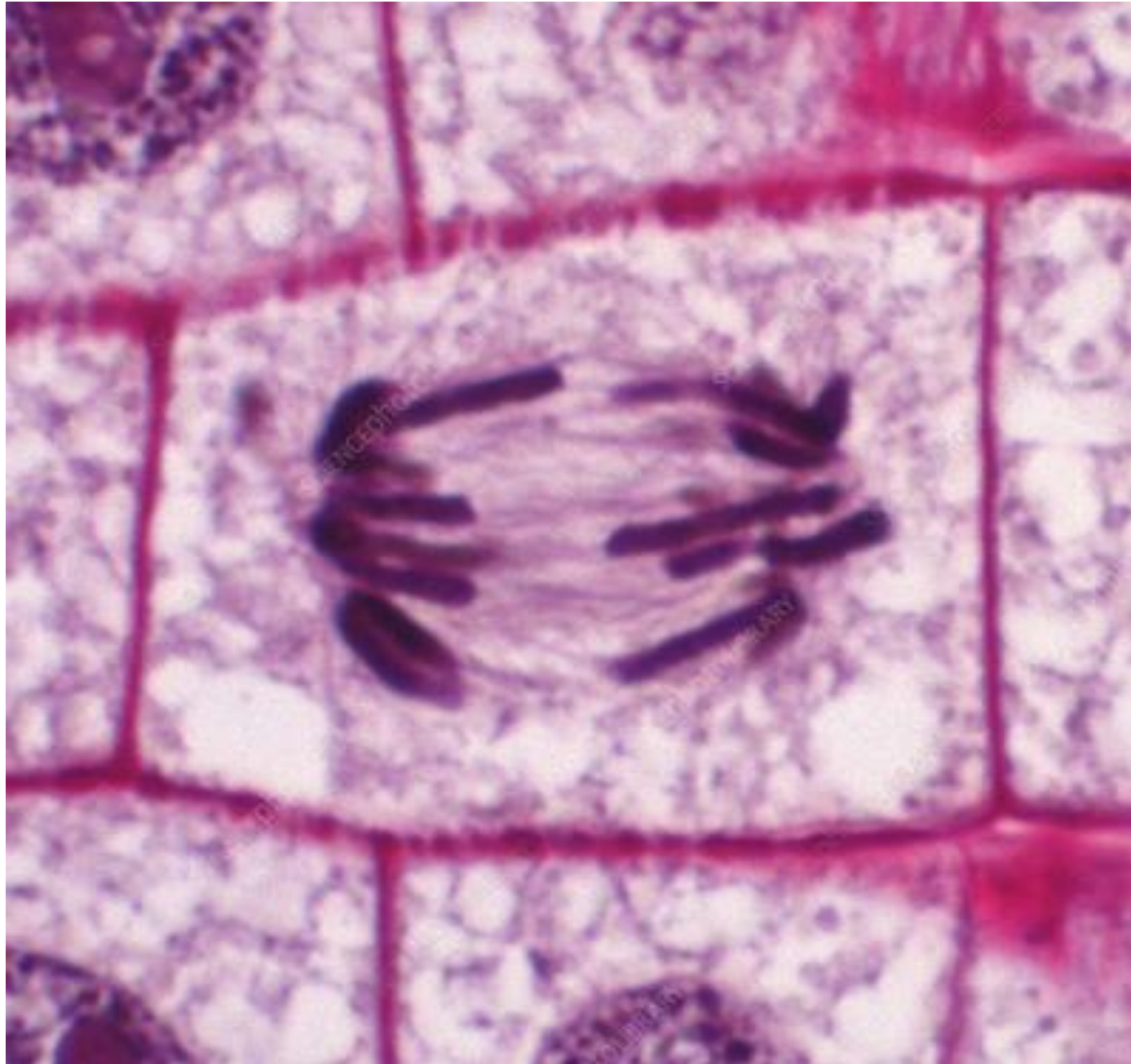
# Prophase:



## ▪ Metaphase:

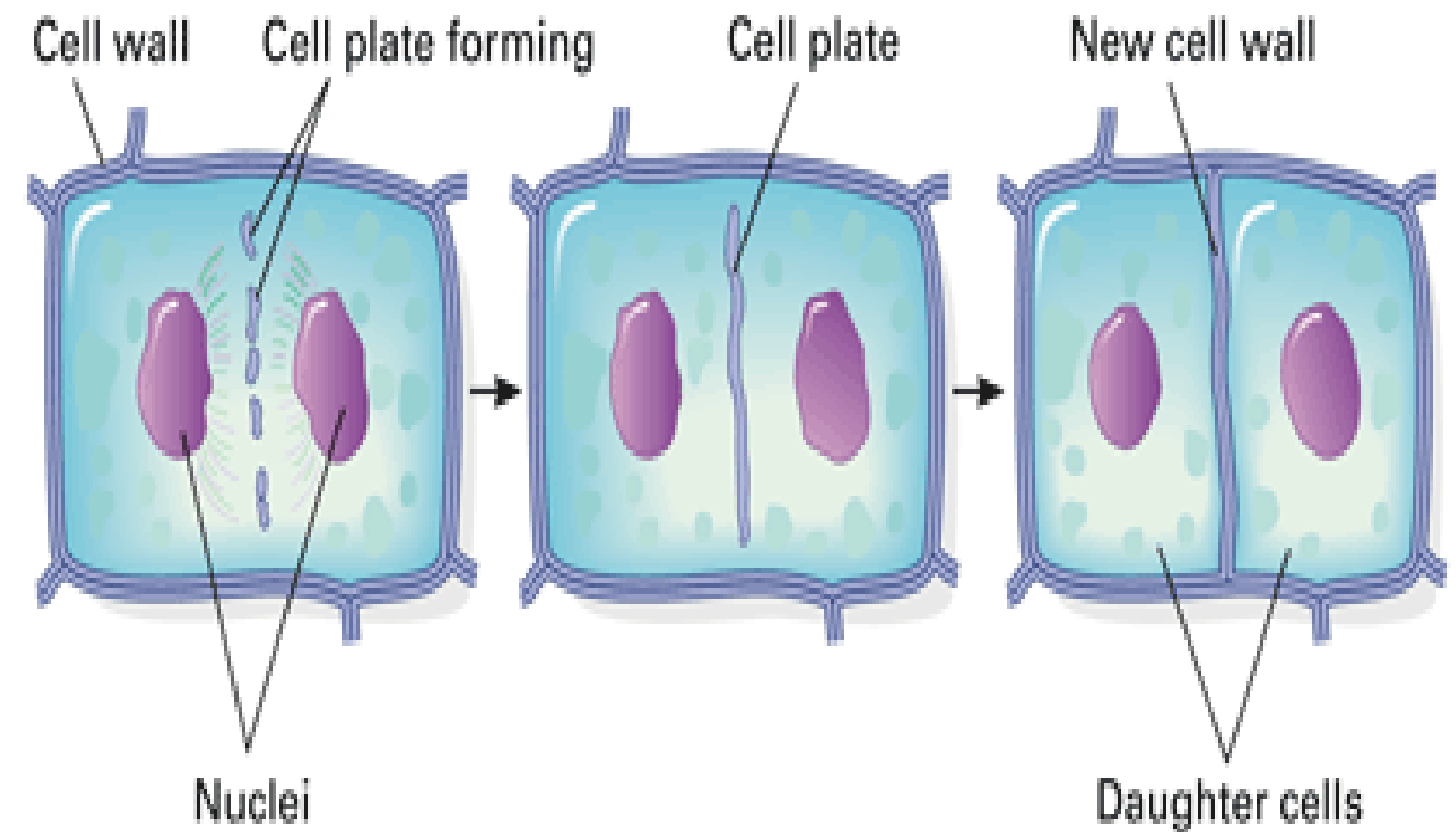
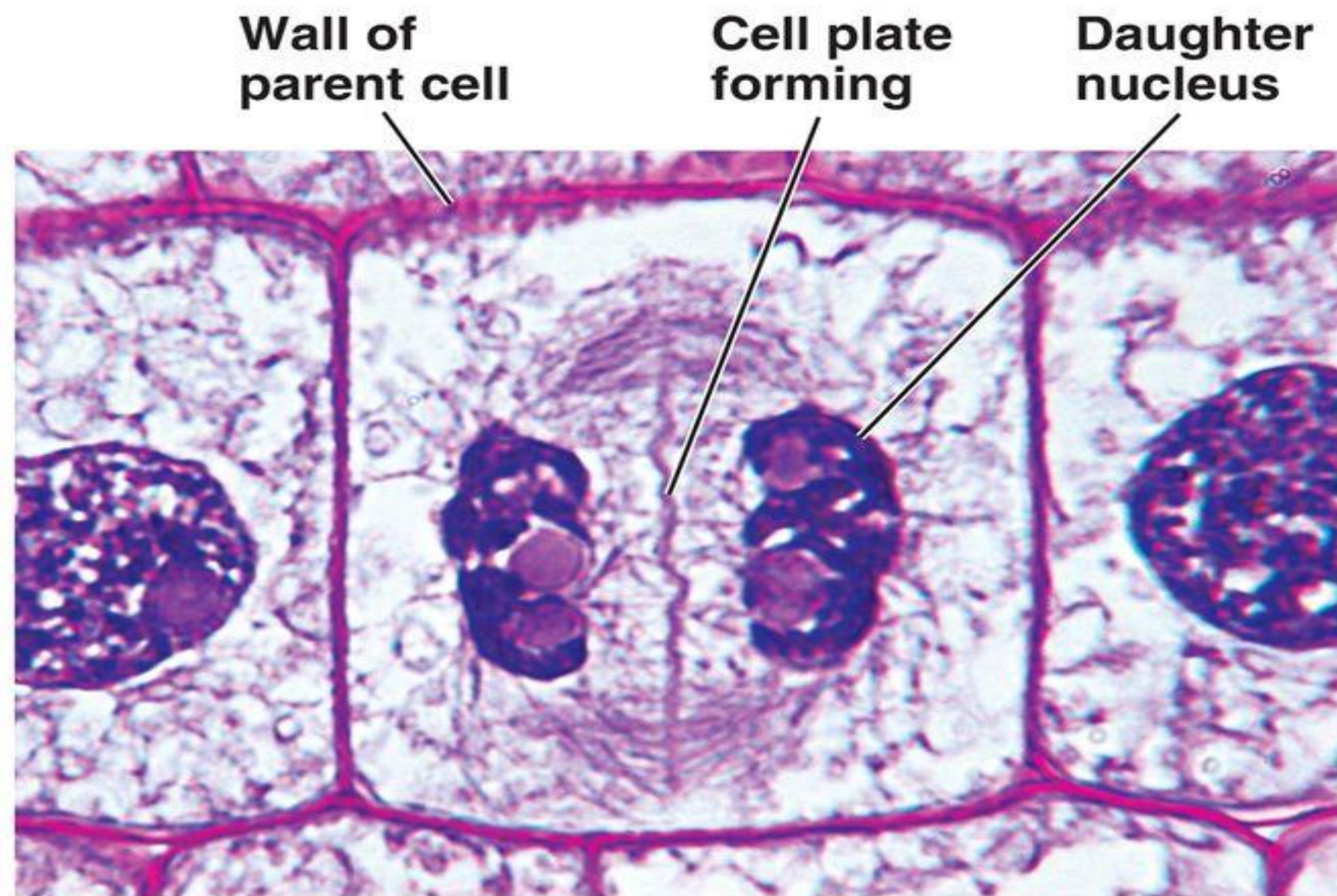


## ▪ Anaphase:



# • Telophase:

## Cell Plate Formation



Video

<https://www.youtube.com/watch?v=5-ur7bWqIDQ>





# References

- Celis, J. E. (Ed.). (2006). Cell biology: a laboratory handbook (Vol. 1). Elsevier.
- Guthrie, C., & Fink, G. R. (Eds.). (2002). Guide to yeast genetics and molecular and cell biology, Part C (Vol. 351). Gulf Professional Publishing.
- Das, D. (2017). ESSENTIAL PRACTICAL HANDBOOK OF CELL BIOLOGY & GENETICS, BIOMETRY & MICROBIOLOGY: A LABORATORY MANUAL. Academic Publishers.