

In eukaryotes, cell division occurs in two major stages.

The first stage, division of the cell nucleus, is called **mitosis**.

The second stage, division of the cell cytoplasm, is called **cytokinesis**.

## Chromosomes

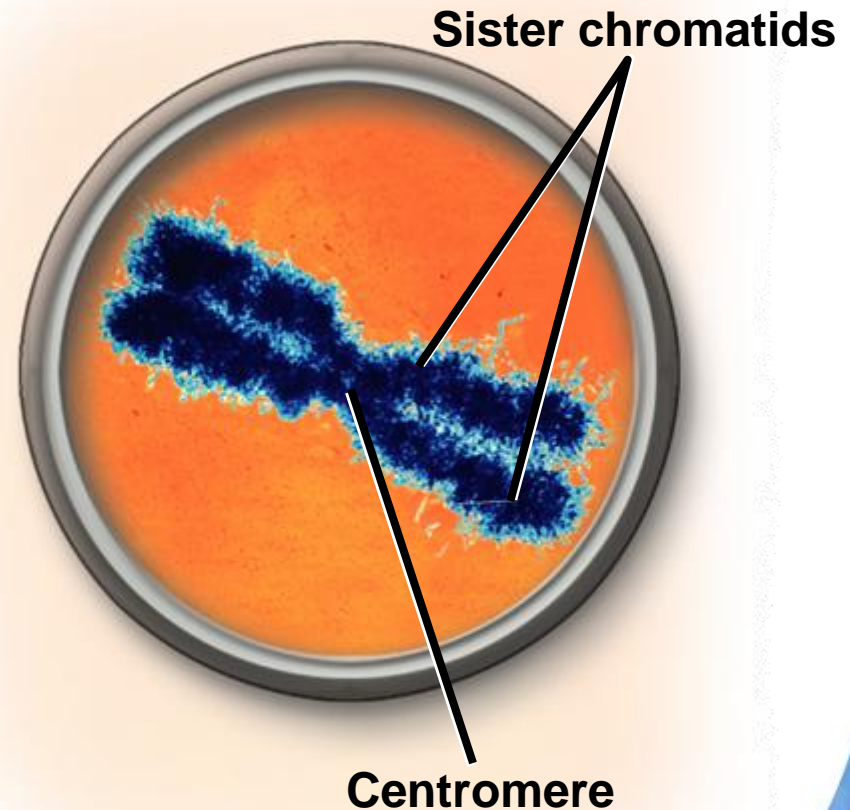
Genetic information is passed from one generation to the next on **chromosomes**.

Before cell division, each chromosome is duplicated, or copied.

Each chromosome consists of two identical “sister” chromatids.

Each pair of chromatids is attached at an area called the **centromere**.

When the cell divides, the chromatids separate. Each new cell gets one chromatid.



# The Cell Cycle

The **cell cycle** is the series of events that cells go through as they grow and divide.

**Interphase** is the period of growth that occurs between cell divisions.

## During the cell cycle:

a cell grows

prepares for division

divides to form two daughter cells, each of which begins the cycle again

The cell cycle consists of four phases:

- $G_1$  (First Gap Phase)
- S Phase
- $G_2$  (Second Gap Phase)
- M Phase

## Events of the Cell Cycle

**During  $G_1$ , the cell**

- increases in size
- synthesizes new proteins and organelles

## During the S phase,

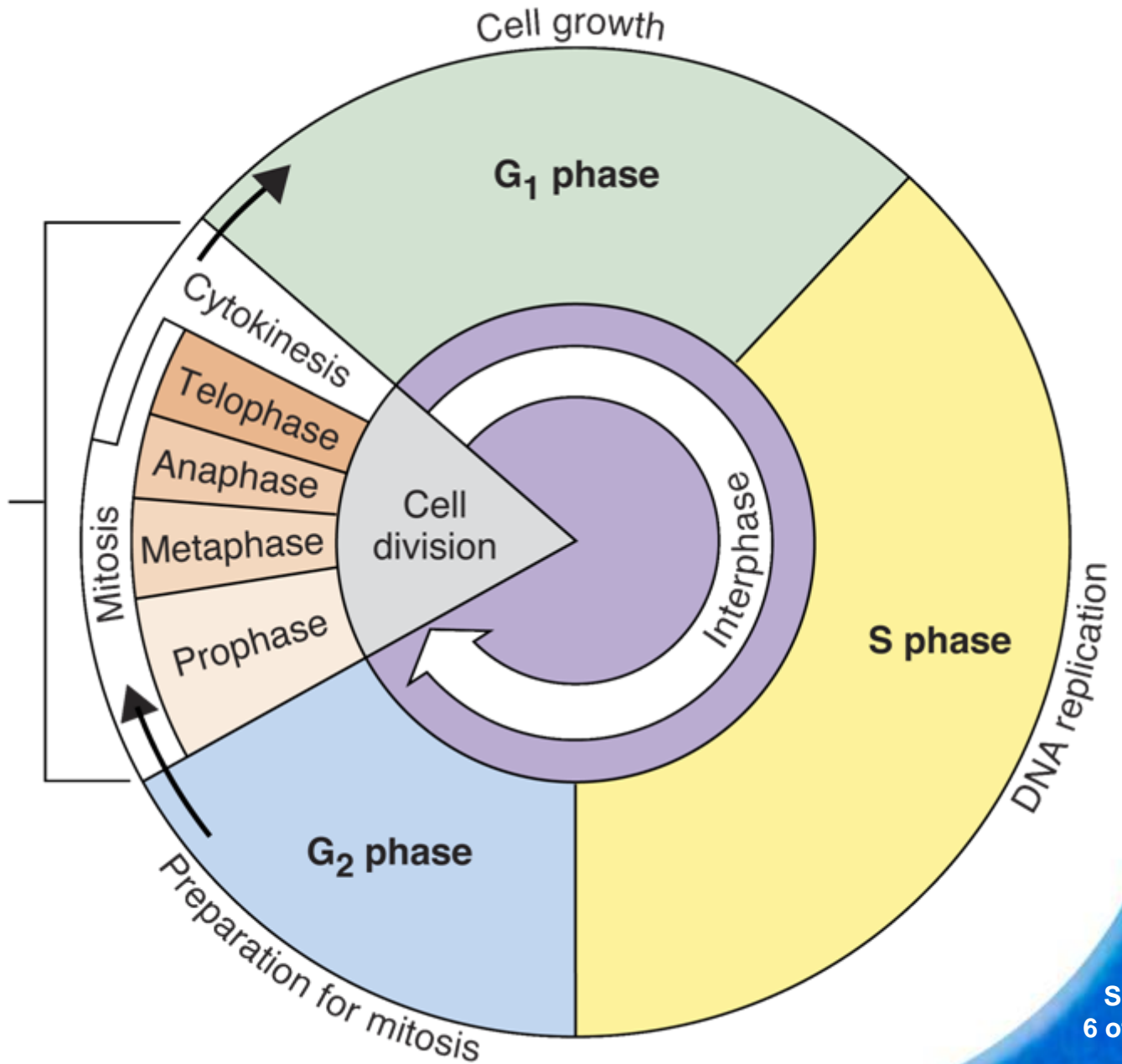
- chromosomes are replicated
- DNA synthesis takes place

Once a cell enters the S phase, it usually completes the rest of the cell cycle.

## The G<sub>2</sub> Phase (Second Gap Phase)

- organelles and molecules required for cell division are produced
- Once G<sub>2</sub> is complete, the cell is ready to start the M phase—Mitosis

# Cell Cycle



<http://www.argosymedical.com/Cellular/samples/animations/Mitosis/index.html>

# Mitosis



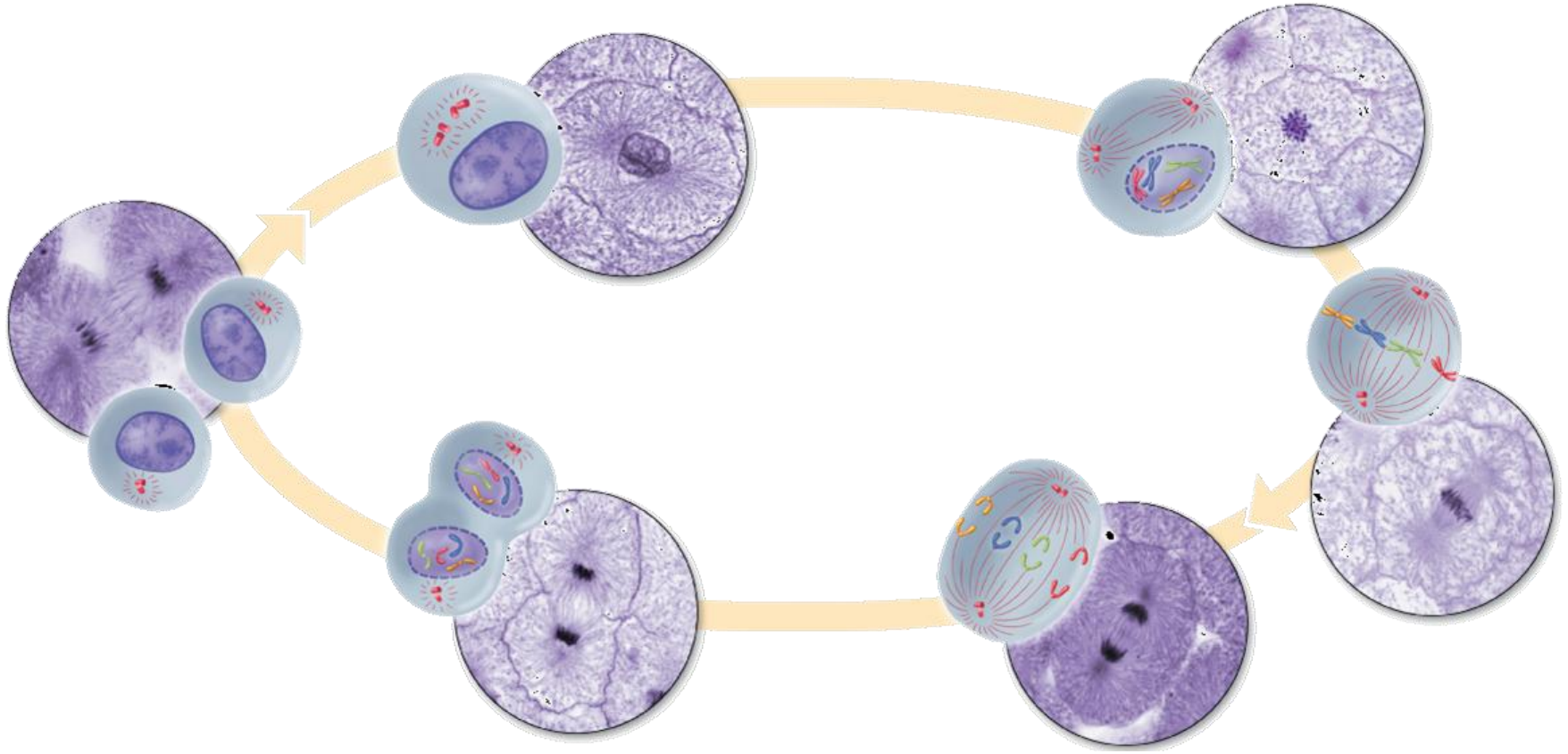
**Biologists divide the events of mitosis into four phases:**

- **Prophase**
- **Metaphase**
- **Anaphase**
- **Telophase**



# 10-2 Cell Division → Mitosis

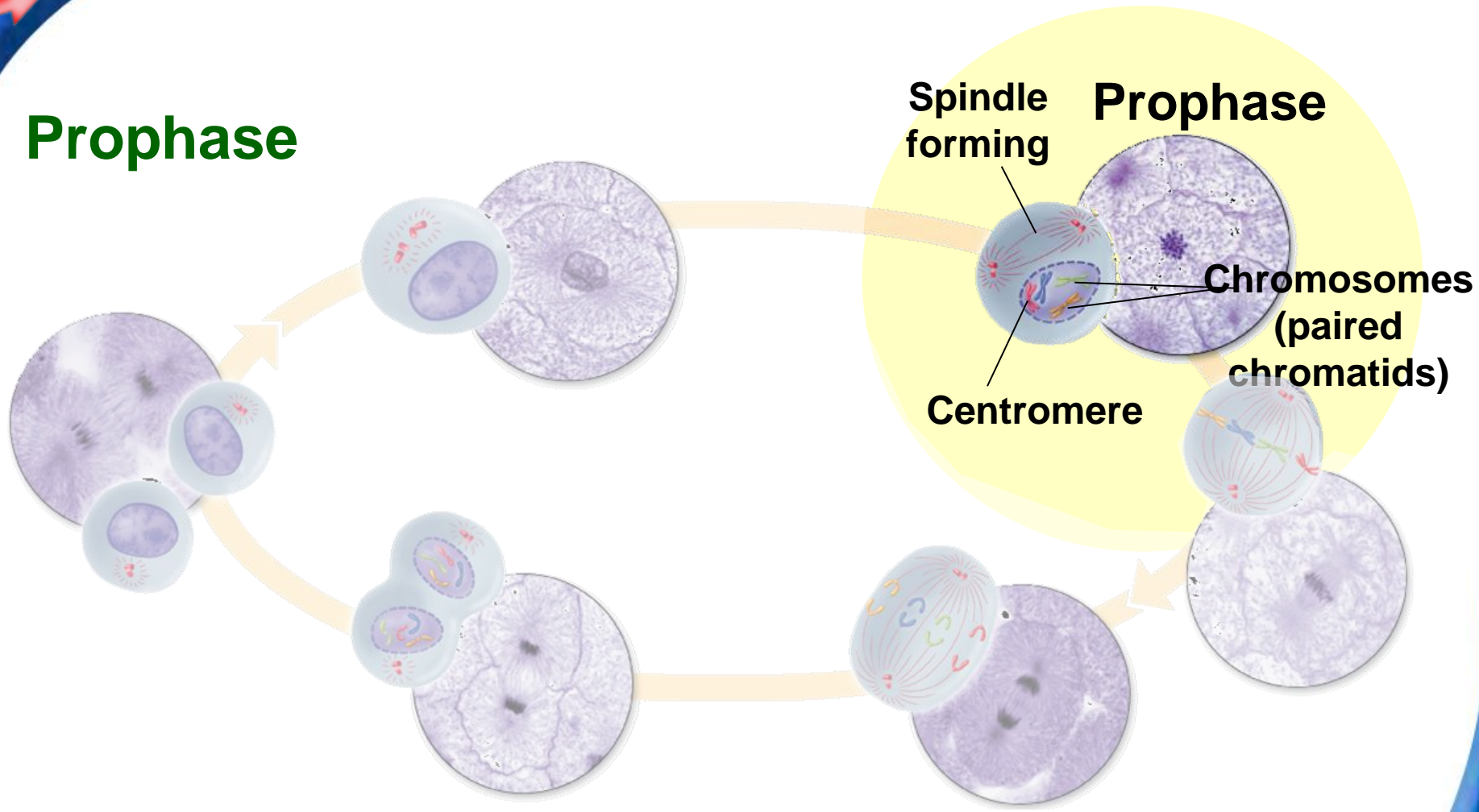
**movie**  
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## Mitosis



# Prophase

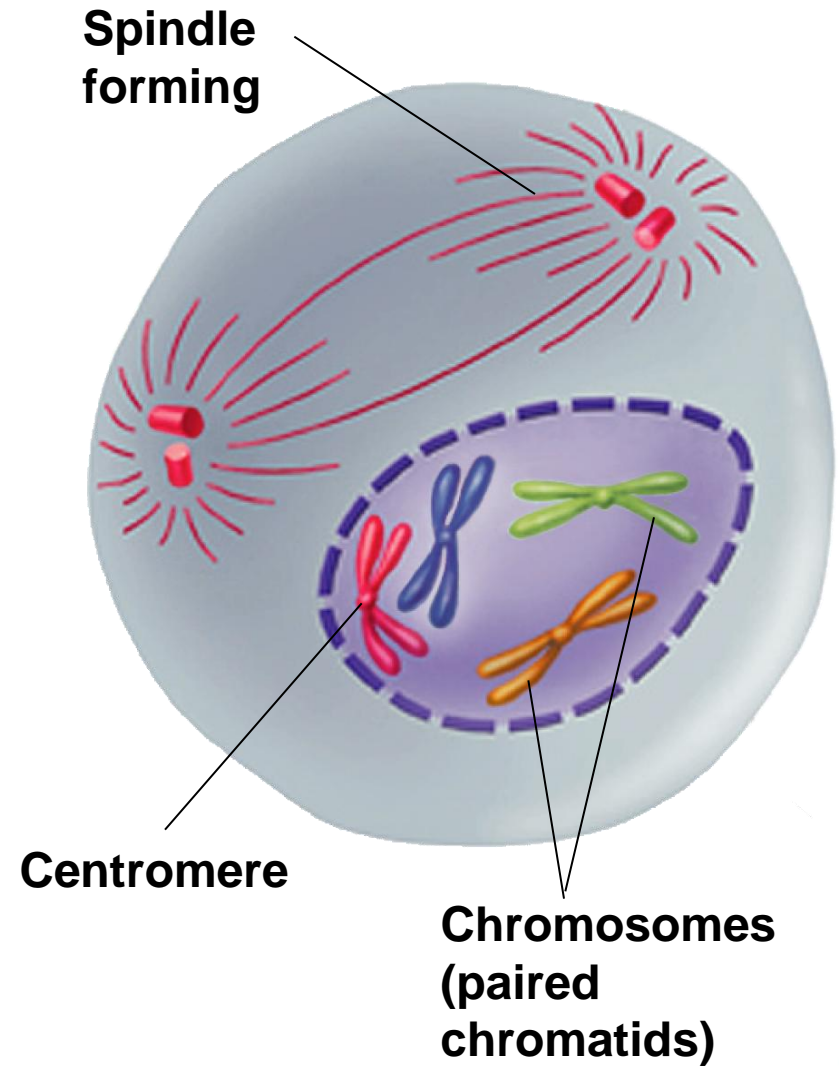


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## Prophase

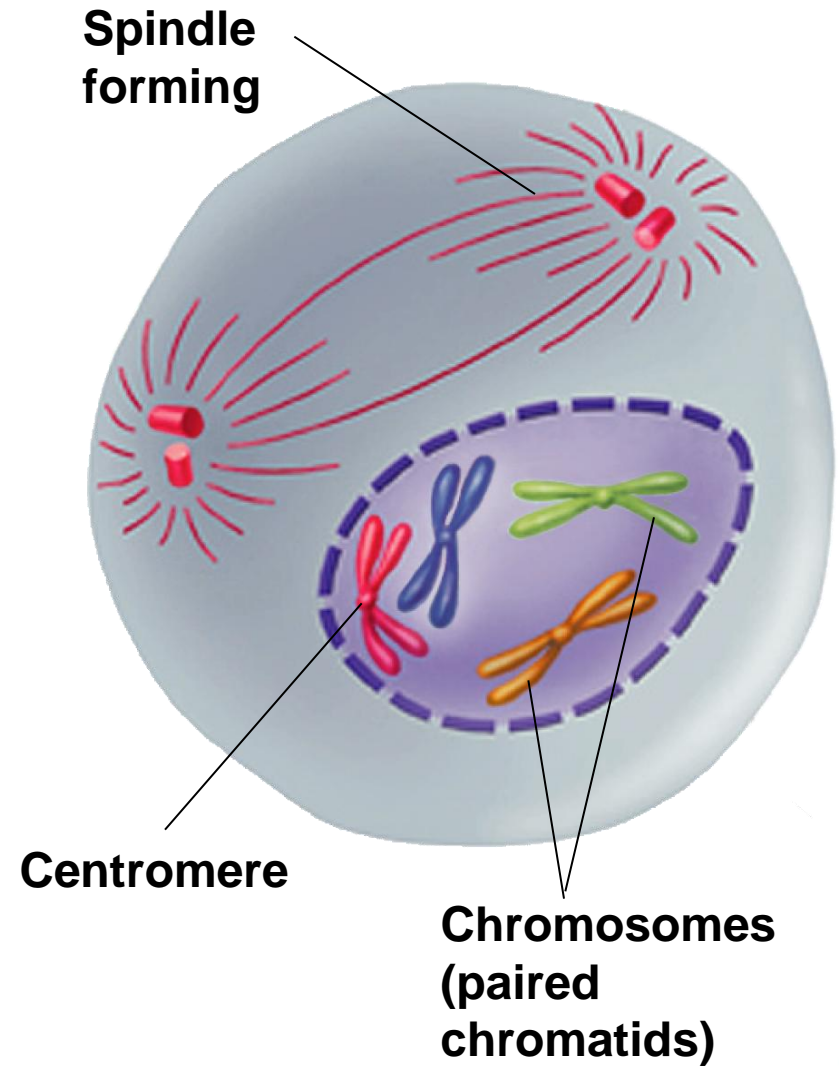
Prophase is the first and longest phase of mitosis.

The **centrioles** separate and take up positions on opposite sides of the nucleus.



The centrioles lie in a region called the centrosome.

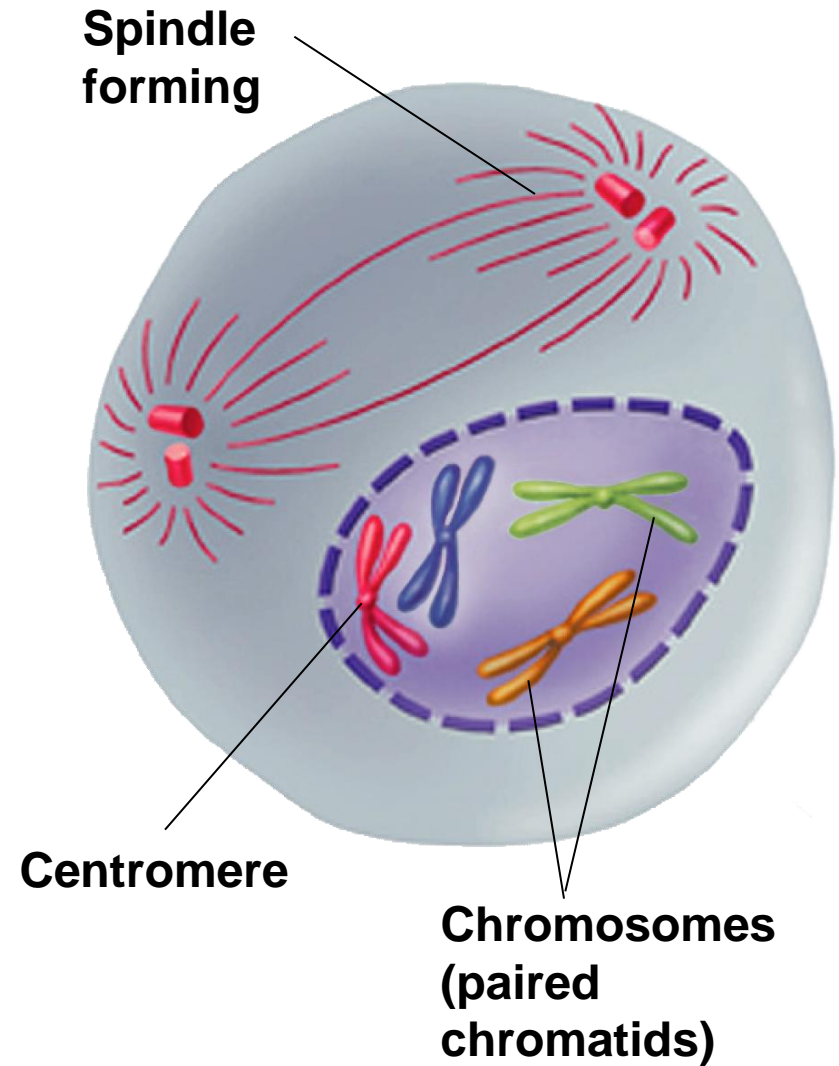
The centrosome helps to organize the **spindle**, a fanlike microtubule structure that helps separate the chromosomes.



Chromatin condenses into chromosomes.

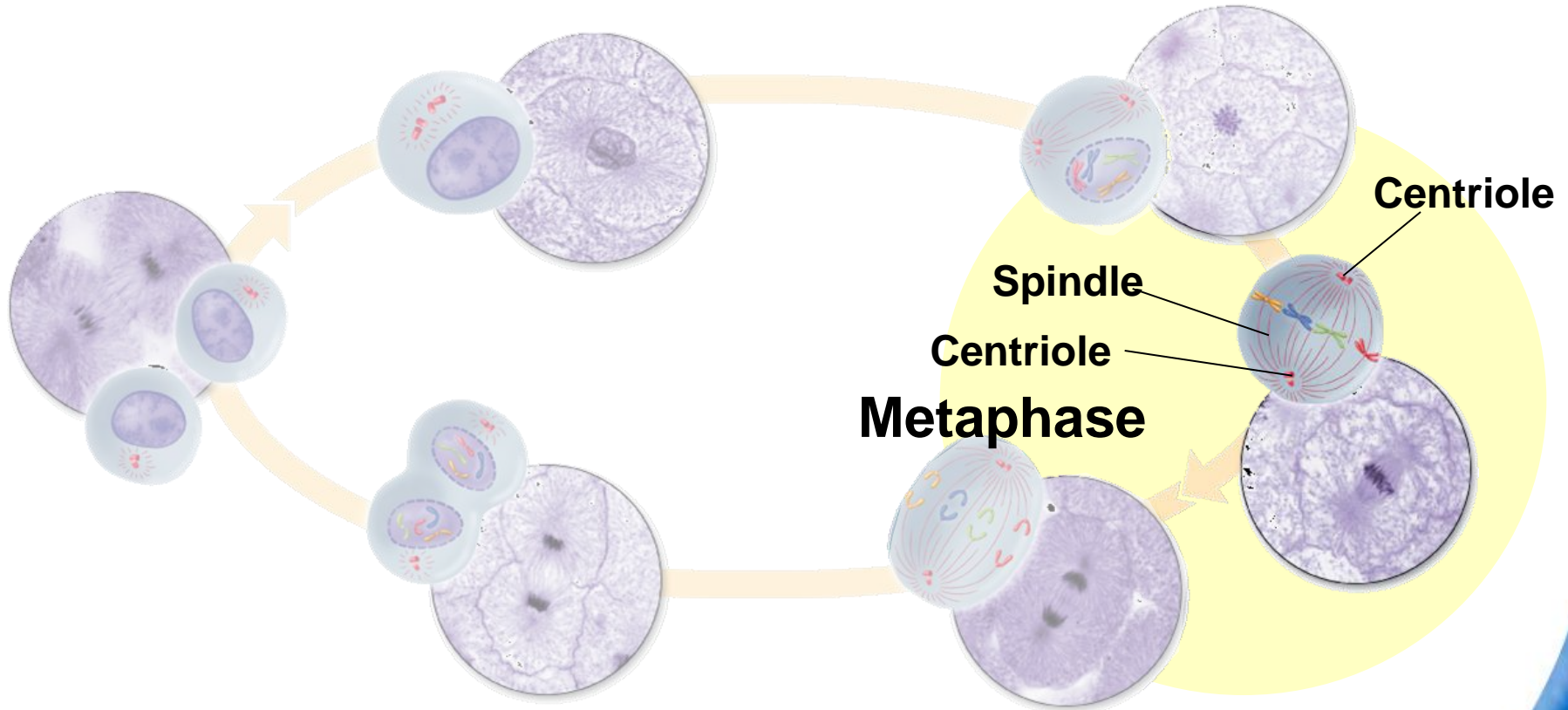
The centrioles separate and a spindle begins to form.

The nuclear envelope breaks down.





# Metaphase



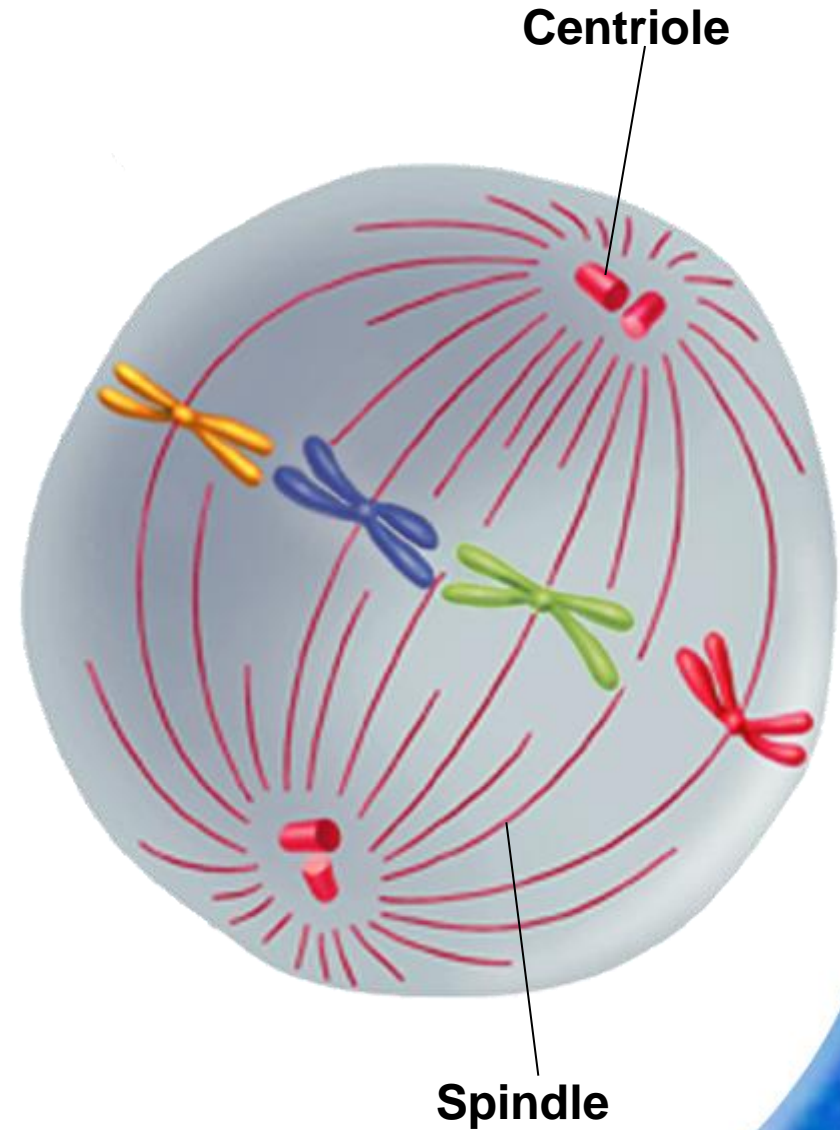
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## Metaphase

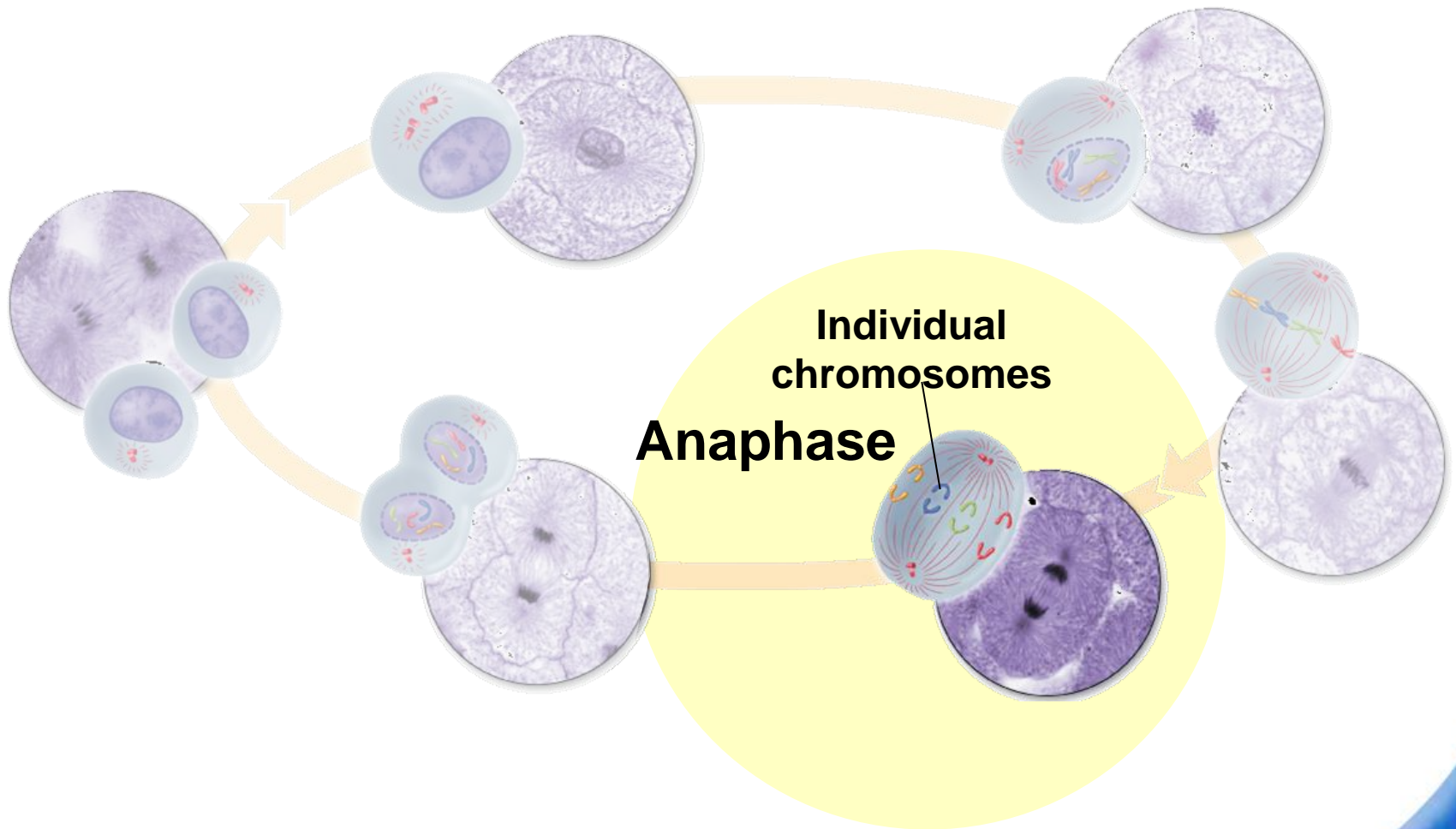
The second phase of mitosis is metaphase.

The chromosomes line up across the middle of the cell.

Microtubules connect the centromere of each chromosome to the poles of the spindle.



# Anaphase





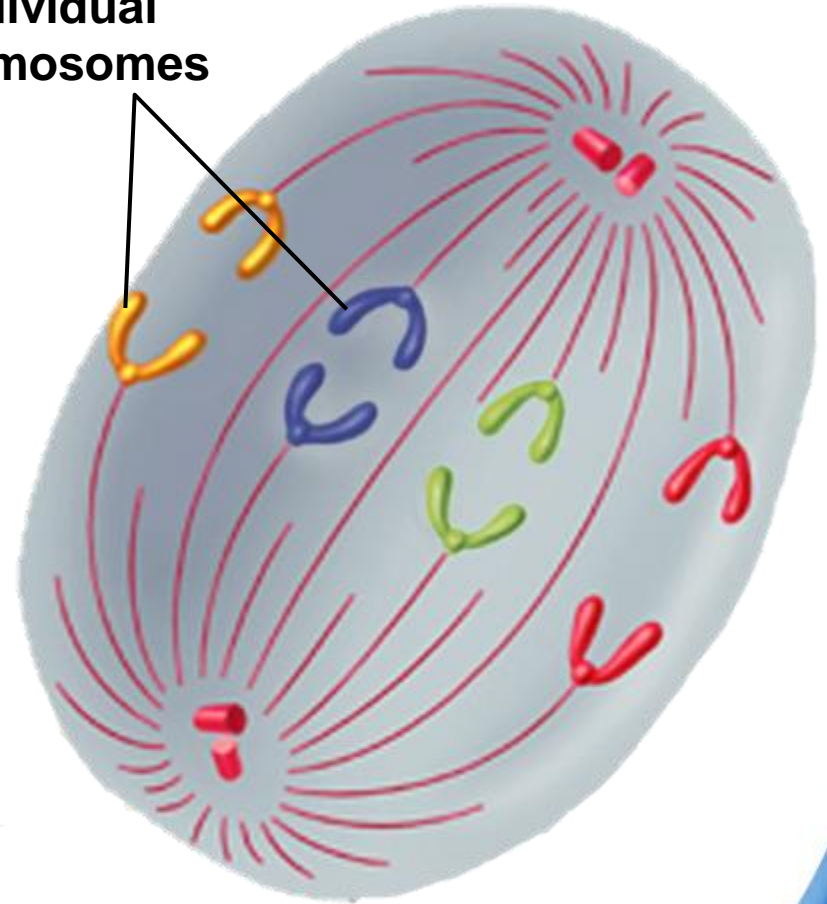
## Anaphase

Anaphase is the third phase of mitosis.

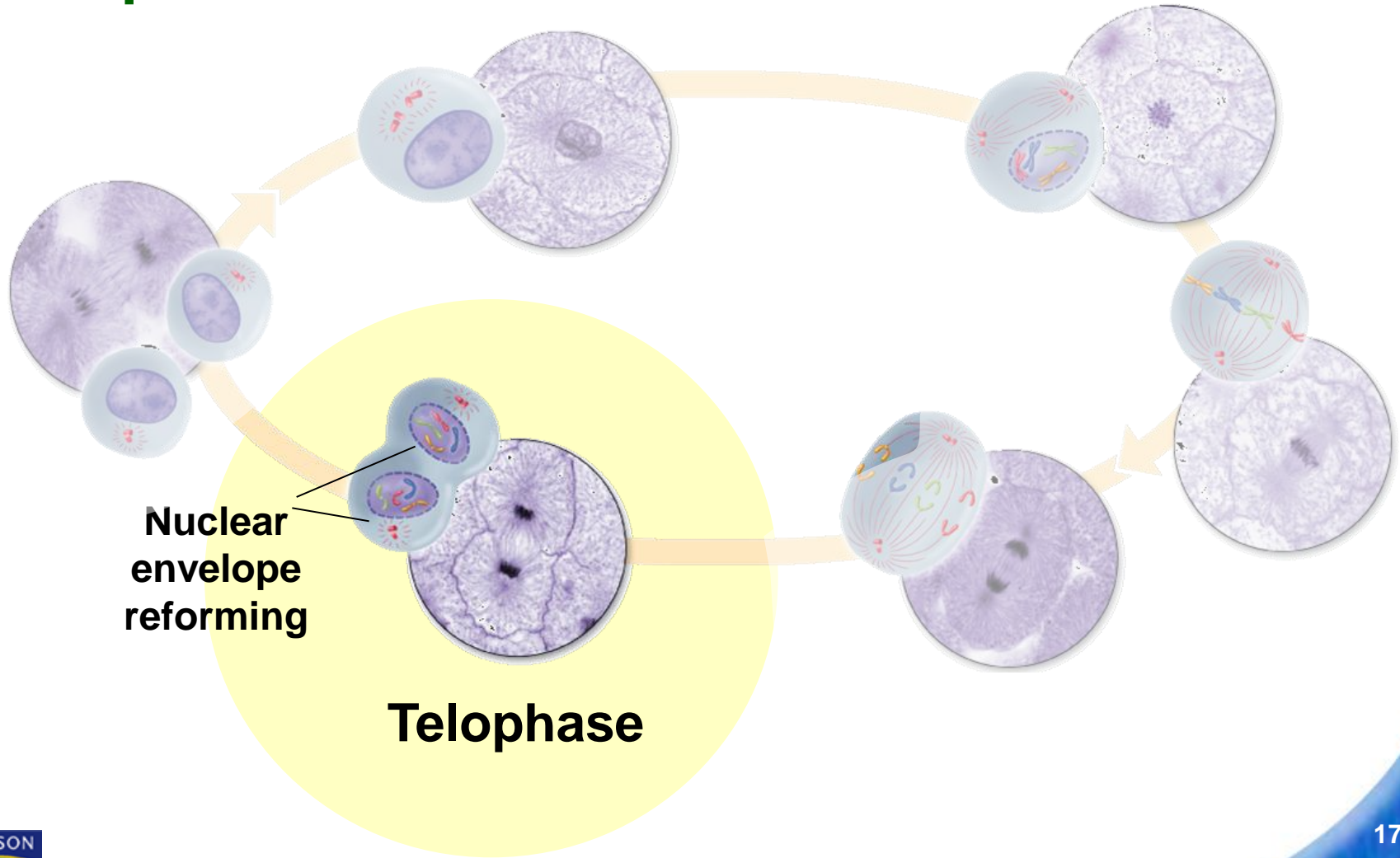
The sister chromatids separate into individual chromosomes.

The chromosomes continue to move until they have separated into two groups.

Individual chromosomes



# Telophase

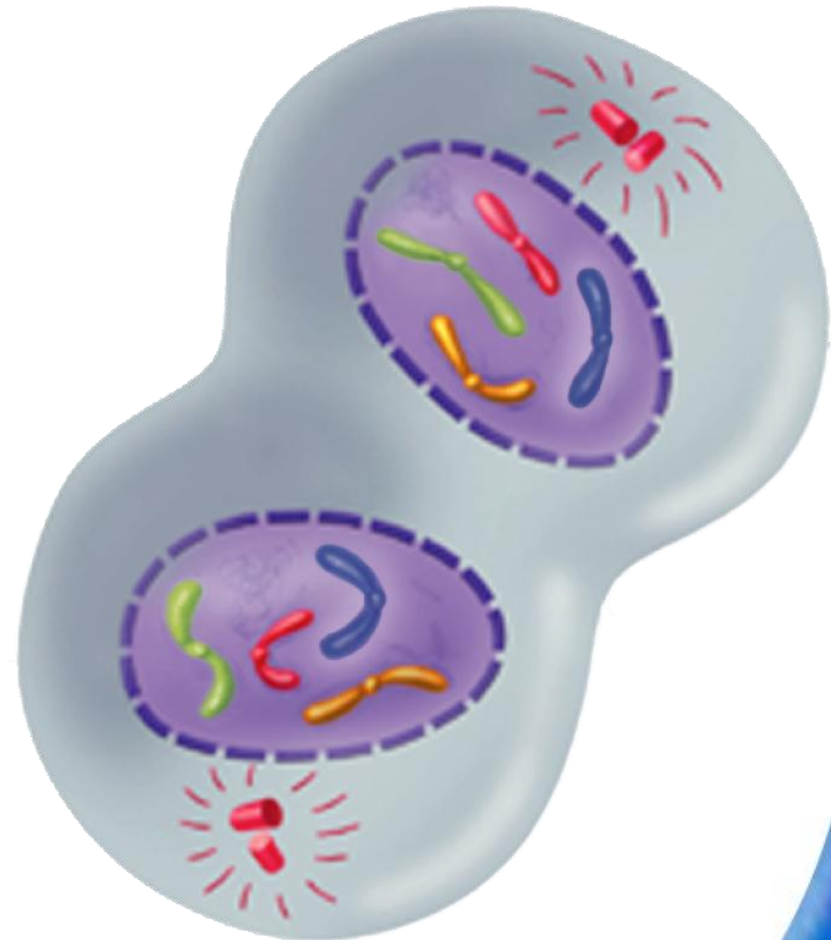


## Telophase

Telophase is the fourth and final phase of mitosis.

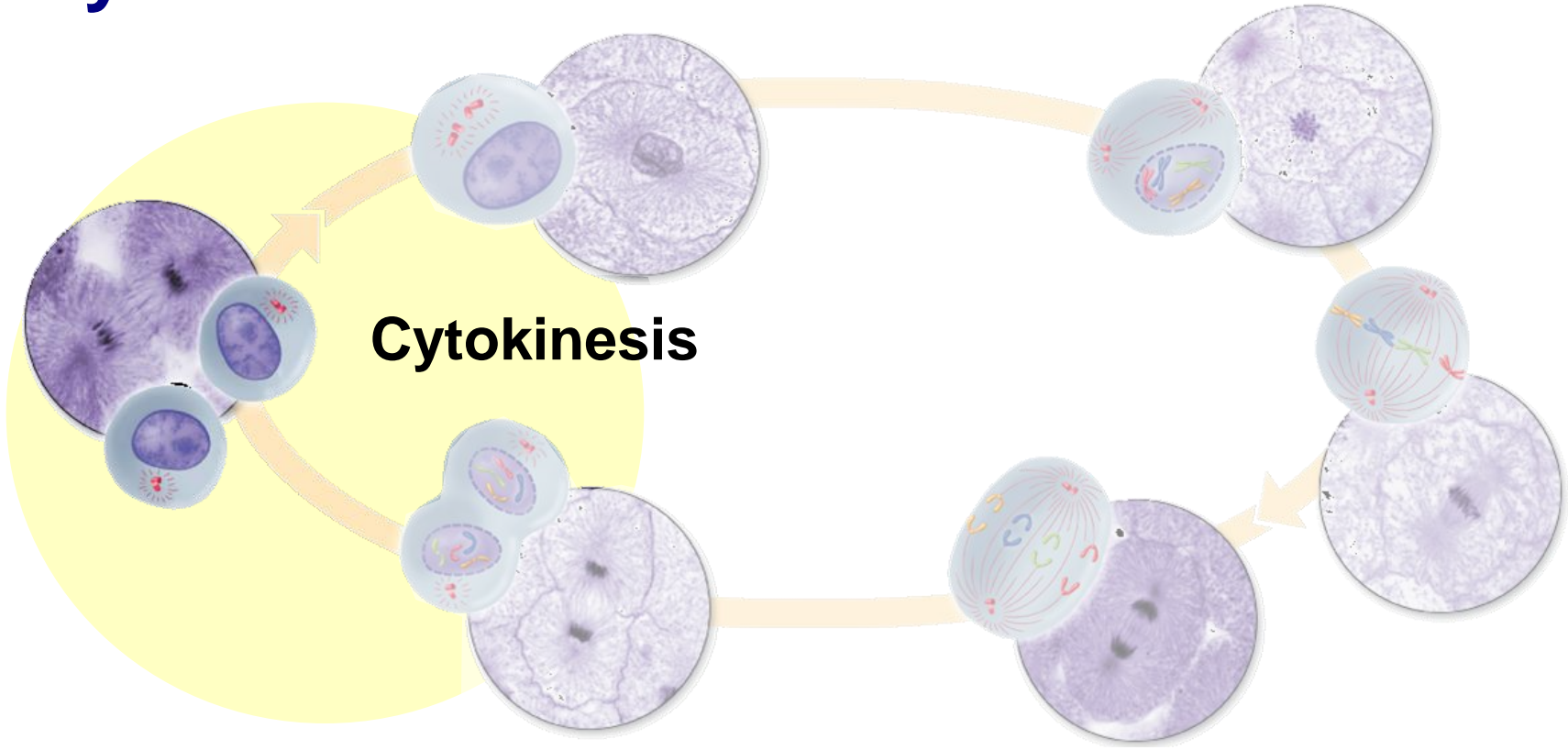
Chromosomes gather at opposite ends of the cell and lose their distinct shape.

A new nuclear envelope forms around each cluster of chromosomes.



**movie**  
click to start

# Cytokinesis





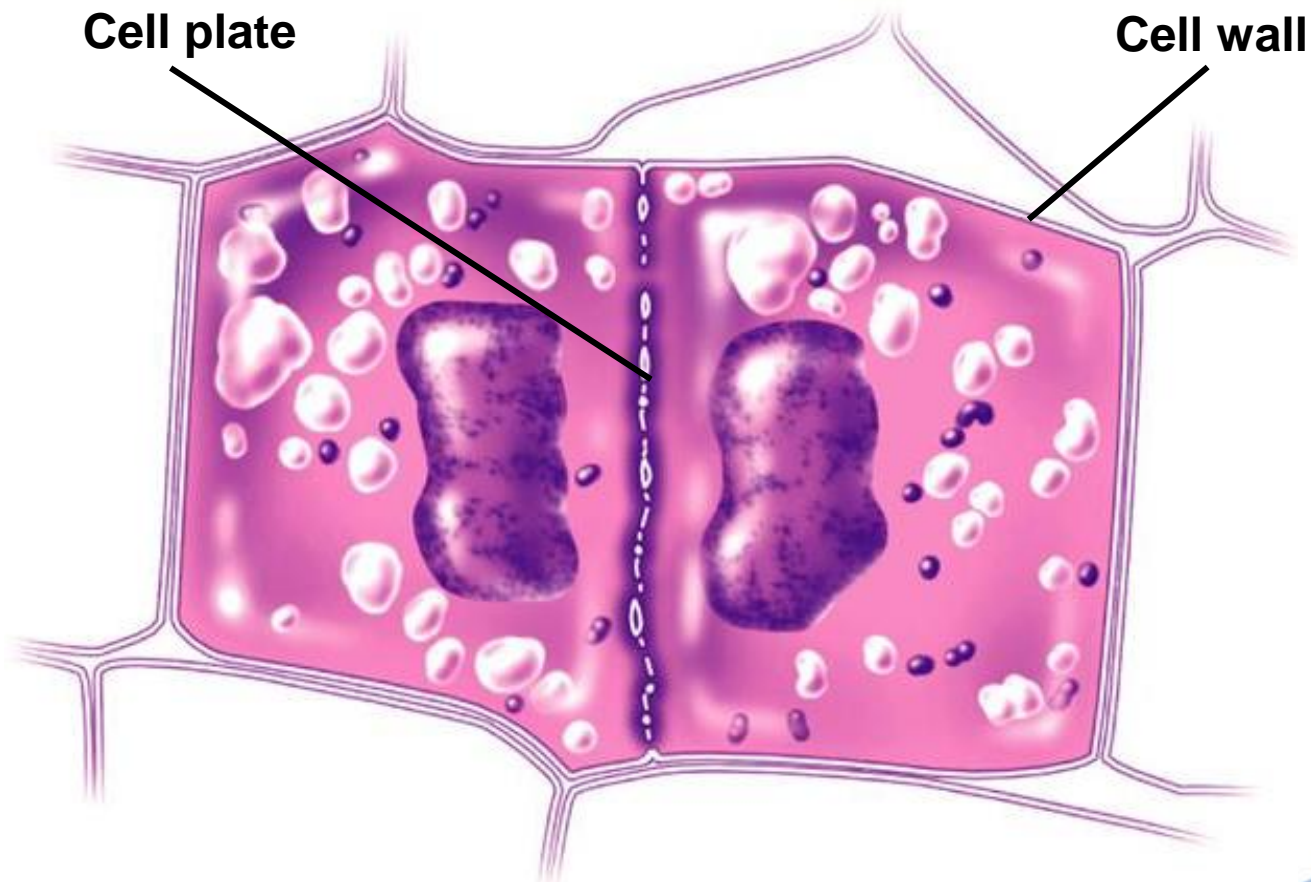
During cytokinesis, the cytoplasm pinches in half.

Each daughter cell has an identical set of duplicate chromosomes.



## 10-2 Cell Division → Cytokinesis

In plants, a structure known as the cell plate forms midway between the divided nuclei.



The cell plate gradually develops into a separating membrane.

A cell wall then begins to appear in the cell plate.



# 10-2 Section QUIZ

Continue to:

**Section QUIZ**

- or -

Click to Launch:



## 10-2 Section QUIZ

**1** The series of events that cells go through as they grow and divide is called

a. the cell cycle.

b. mitosis.

c. interphase.

d. cytokinesis.

## 10-2 Section QUIZ

2 The phase of mitosis during which the chromosomes line up across the center of the cell is

a. prophase.

b. metaphase.

c. anaphase.

d. telophase.

3 Cytokinesis usually occurs

- a. at the same time as telophase.
- b. after telophase.
- c. during interphase.
- d. during anaphase.

## 10-2 Section QUIZ

4 DNA replication takes place during the

- a. S phase of the cell cycle.
- b.  $G_1$  phase of the cell cycle.
- c.  $G_2$  phase of the cell cycle.
- d. M phase of the cell cycle.

## 10-2 Section QUIZ

- 5 During mitosis, “sister” chromatids separate from one another during
- a. telophase.
  - b. interphase.
  - c. anaphase.
  - d. metaphase.

# Section QUIZ



Slide  
29 of 38