

Cell Division

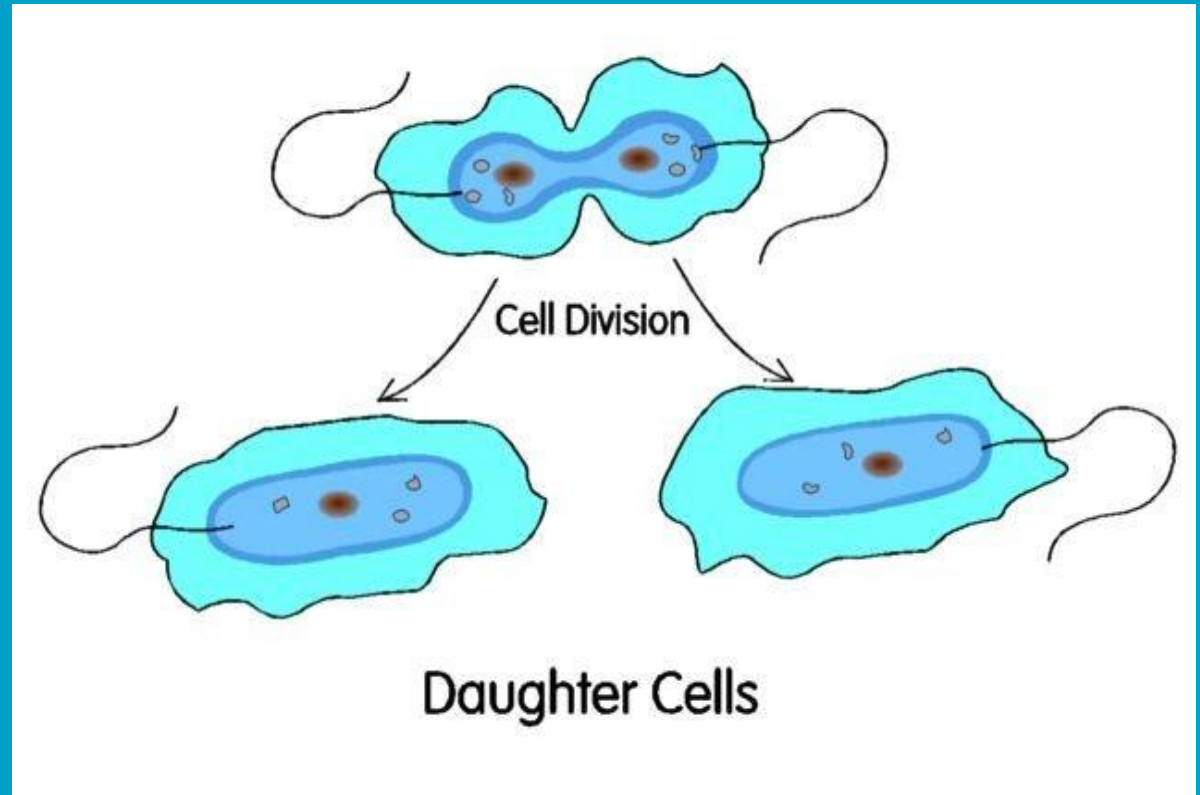
Mitosis & Meiosis

Cell Division

What is it?

Why do
Cells do it?

Why is it
important to
me?

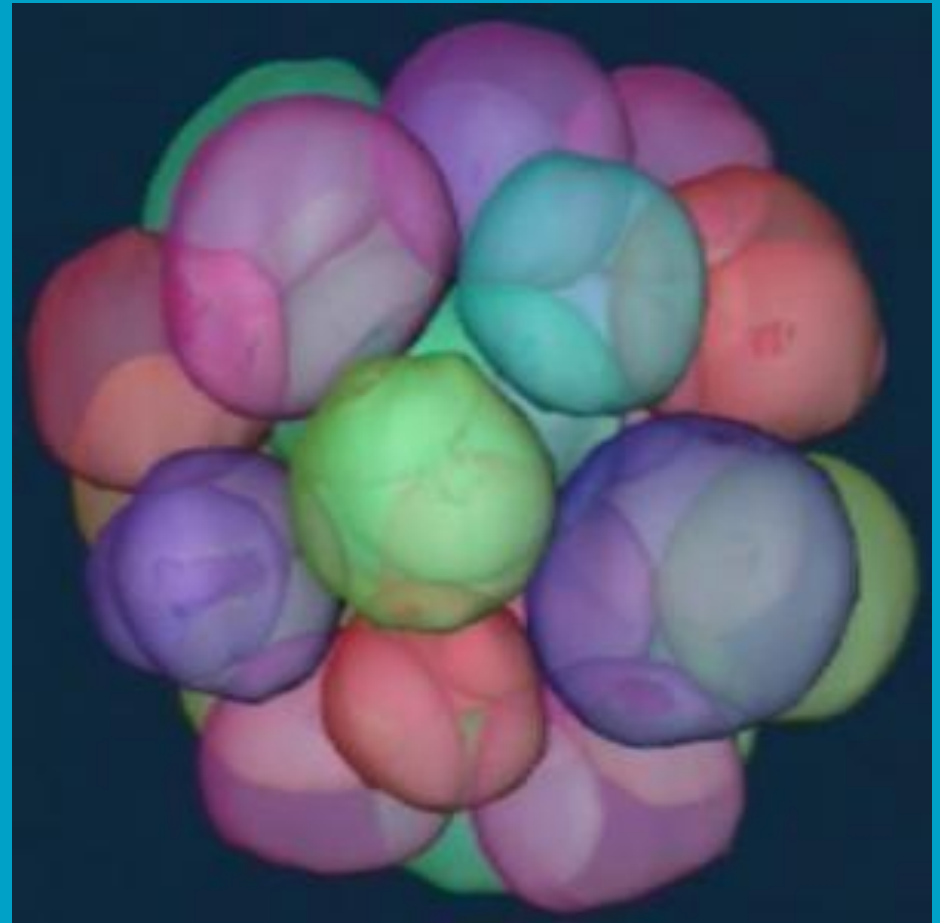


Cell Division

Also known as
Mitosis

Takes place in
Regular Body Cells

Keeps Cells Living
and Growing



interphase

late prophase

prometaphase

10 μ m

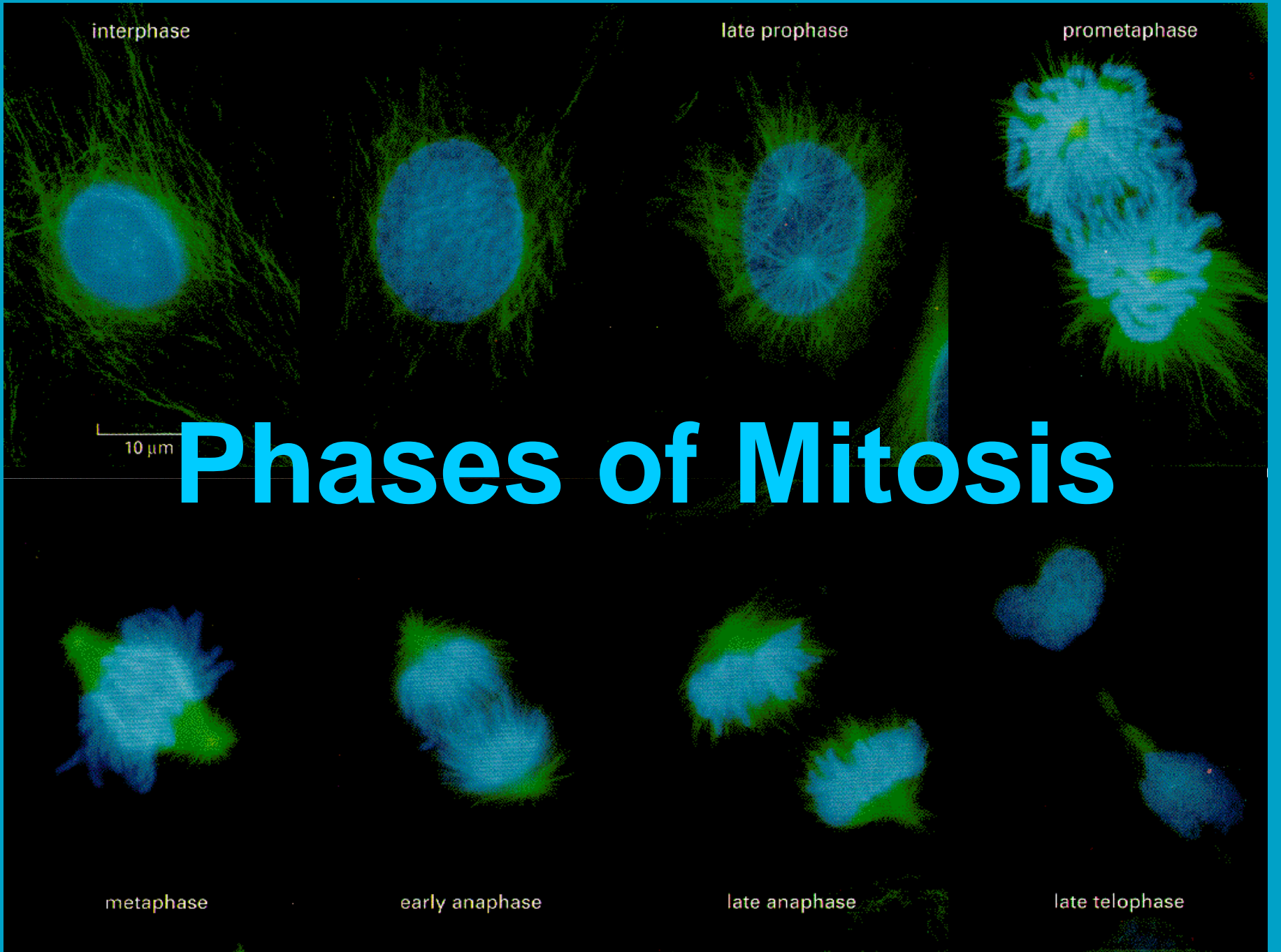
Phases of Mitosis

metaphase

early anaphase

late anaphase

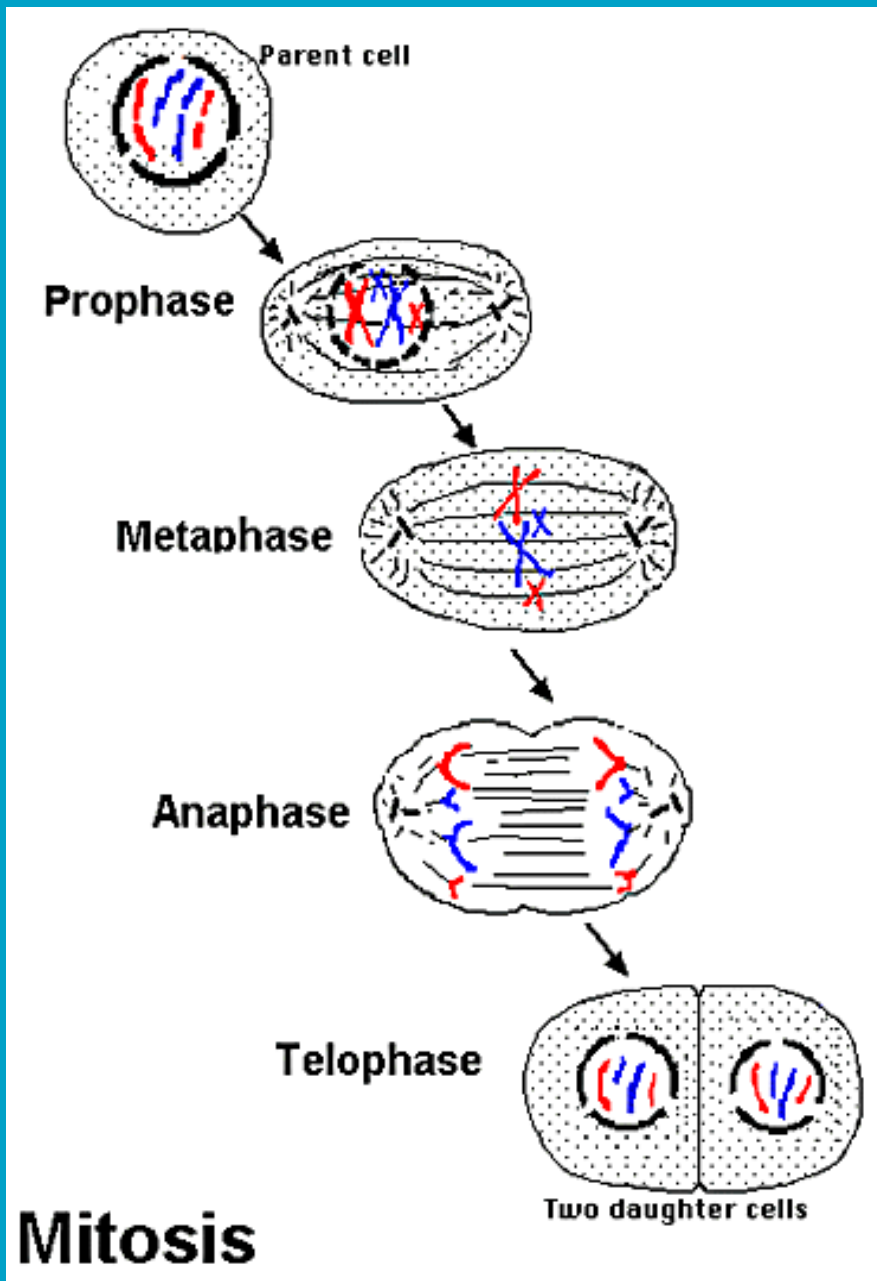
late telophase



Mitosis

The Basic Phases of a Cell's Life:

- Interphase
- Prophase
- Metaphase
- Anaphase
- Telophase
- Cytokinesis



A microscopic image of a cell in interphase. The cell is roughly circular and filled with a dense network of blue-stained chromatin. Several bright yellow-green spots are scattered throughout the nucleus, representing nucleoli. The cell is surrounded by other cells, some of which are in different stages of division, showing spindle fibers and chromosomes.

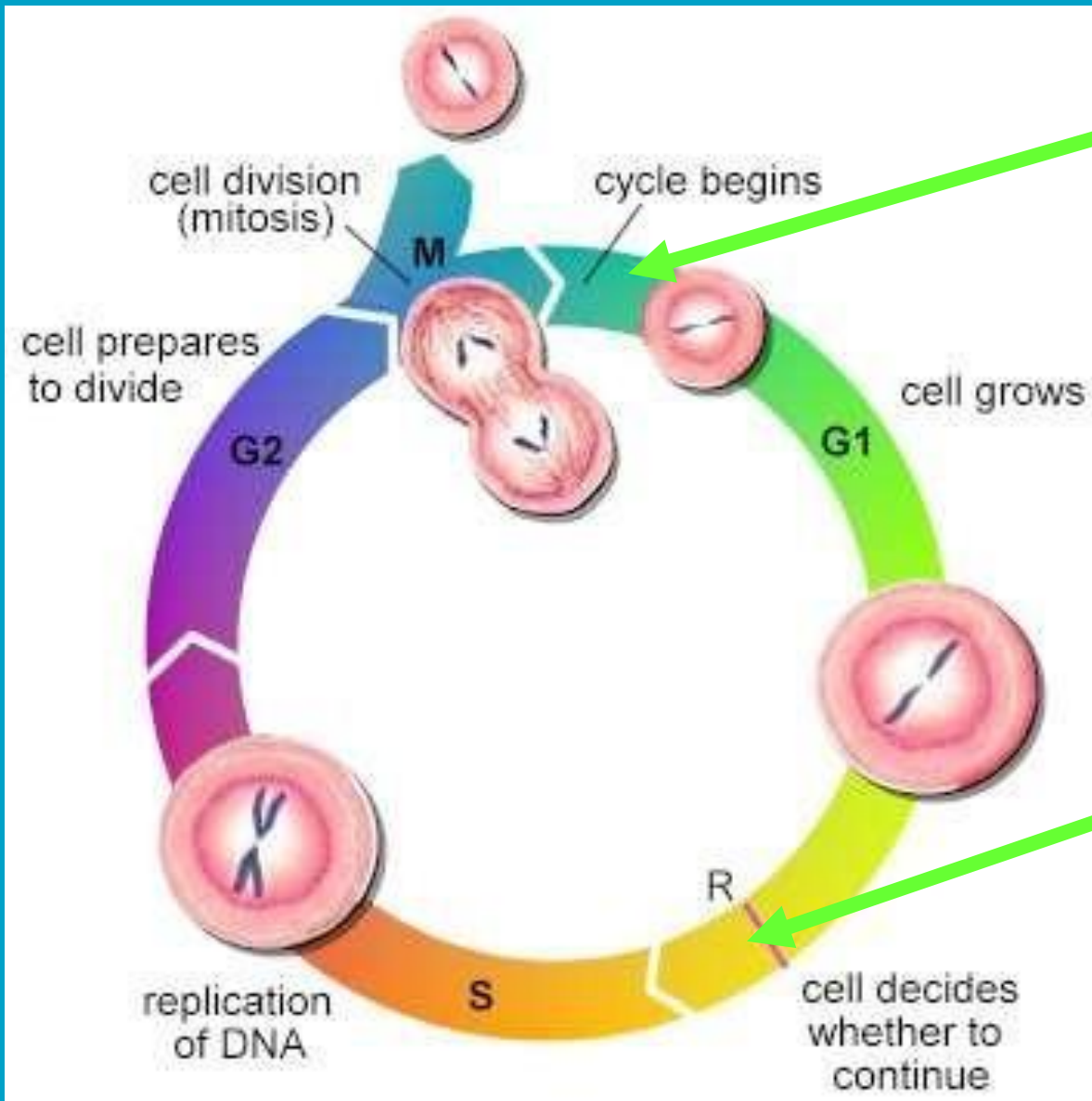
Interphase

The longest stage
of a Cell's life

The time spent
between divisions

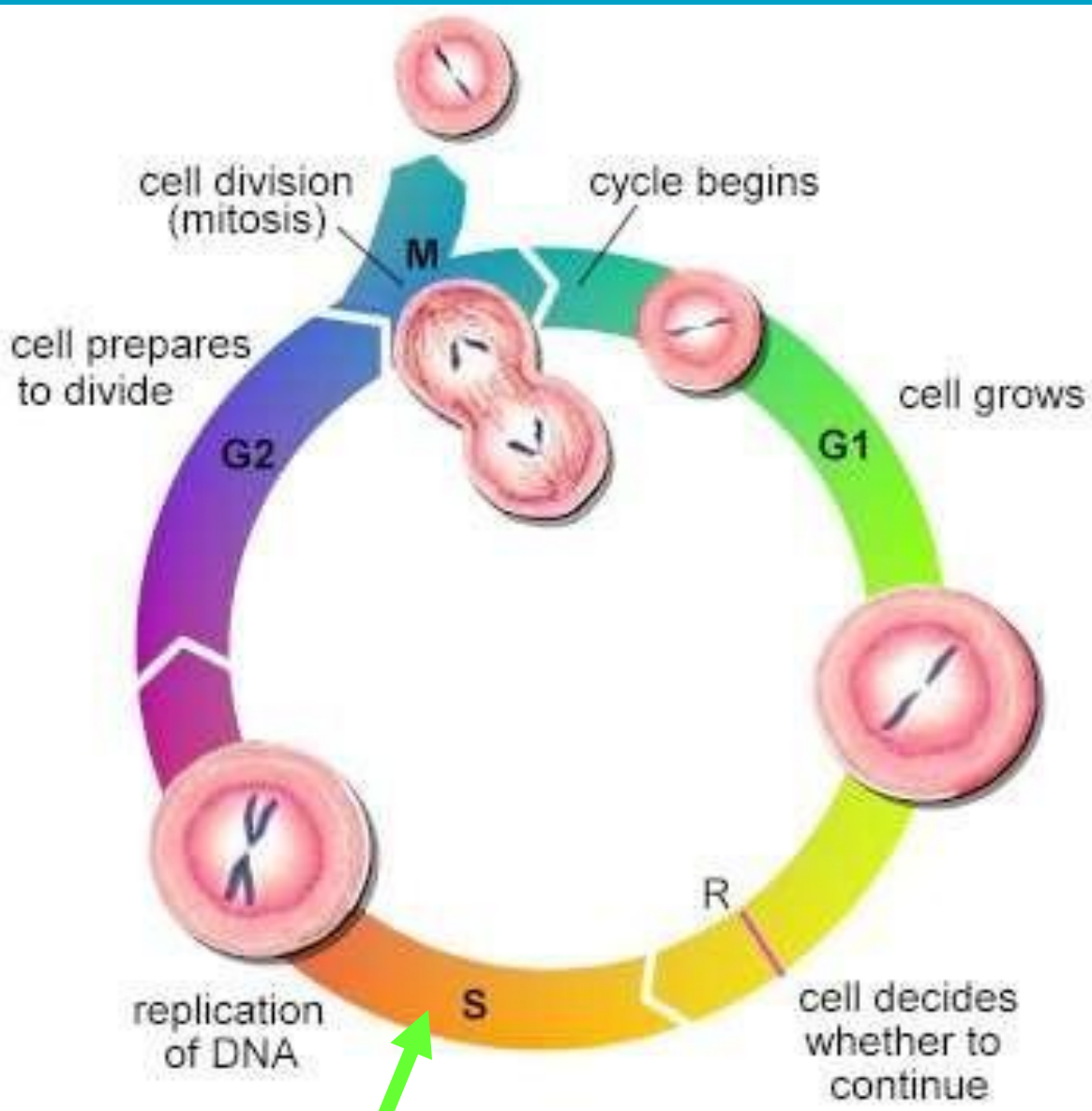
Produces all
materials required
for growth

Preparation for
division



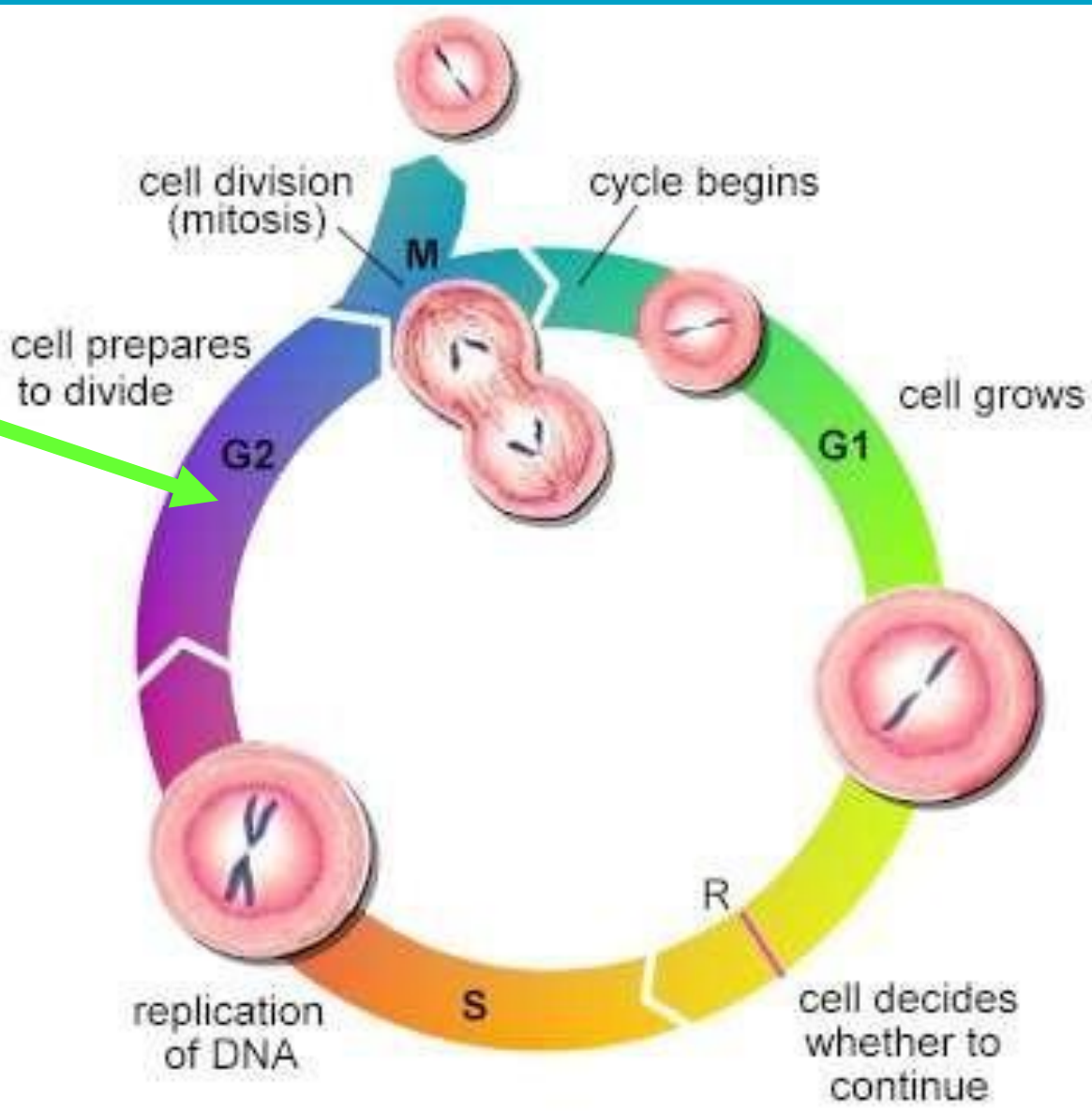
Part of Interphase is also known as the G1 Phase of the Cell Cycle

(Growth Phase)



The Second part of Interphase is known as the S Phase of the Cell Cycle

(Synthesis Phase – when DNA duplicates)

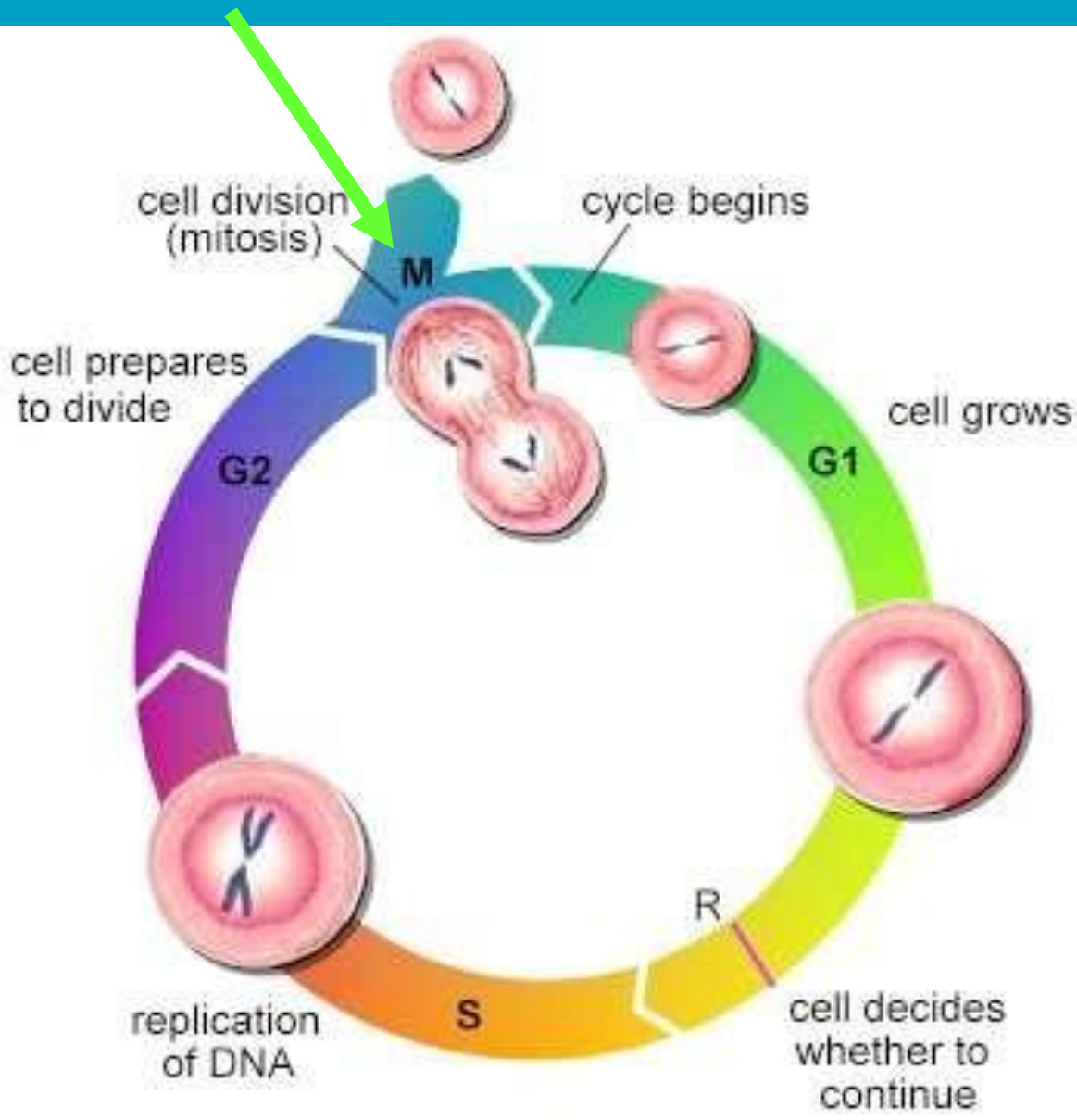


The third part of the Cell Cycle, G2, is just a checkpoint to make sure the DNA is correct.

Next step –

Mitosis

Mitosis: Cell Division



The last part of the Cell Cycle is called Mitosis and has 4 phases during which the cell divides into 2 cells

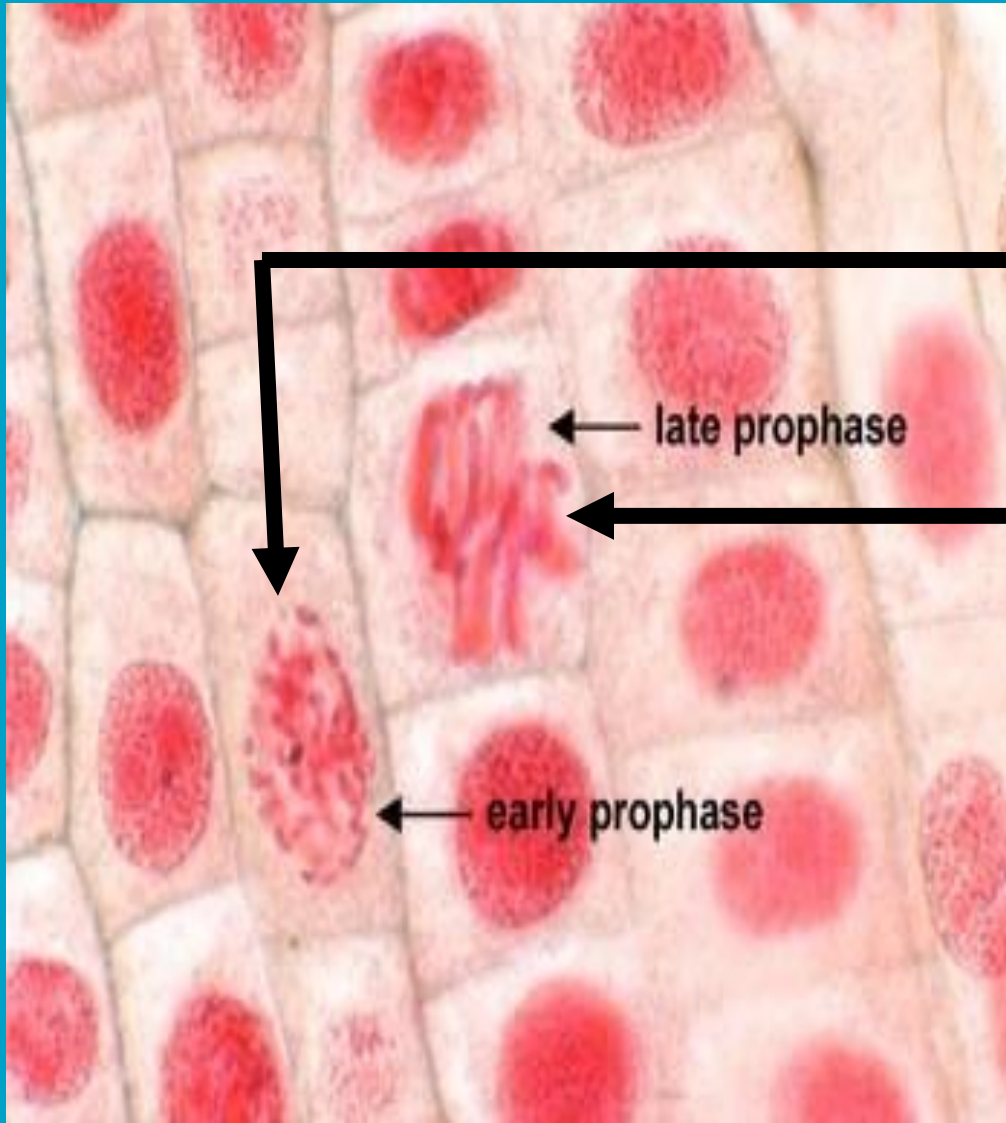


Prophase

The Cell begins
the division
process

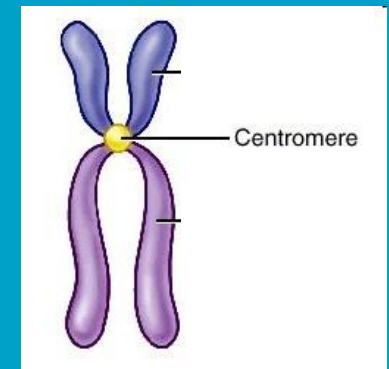
The nucleolus
disappears,

The nuclear
membrane
breaks apart



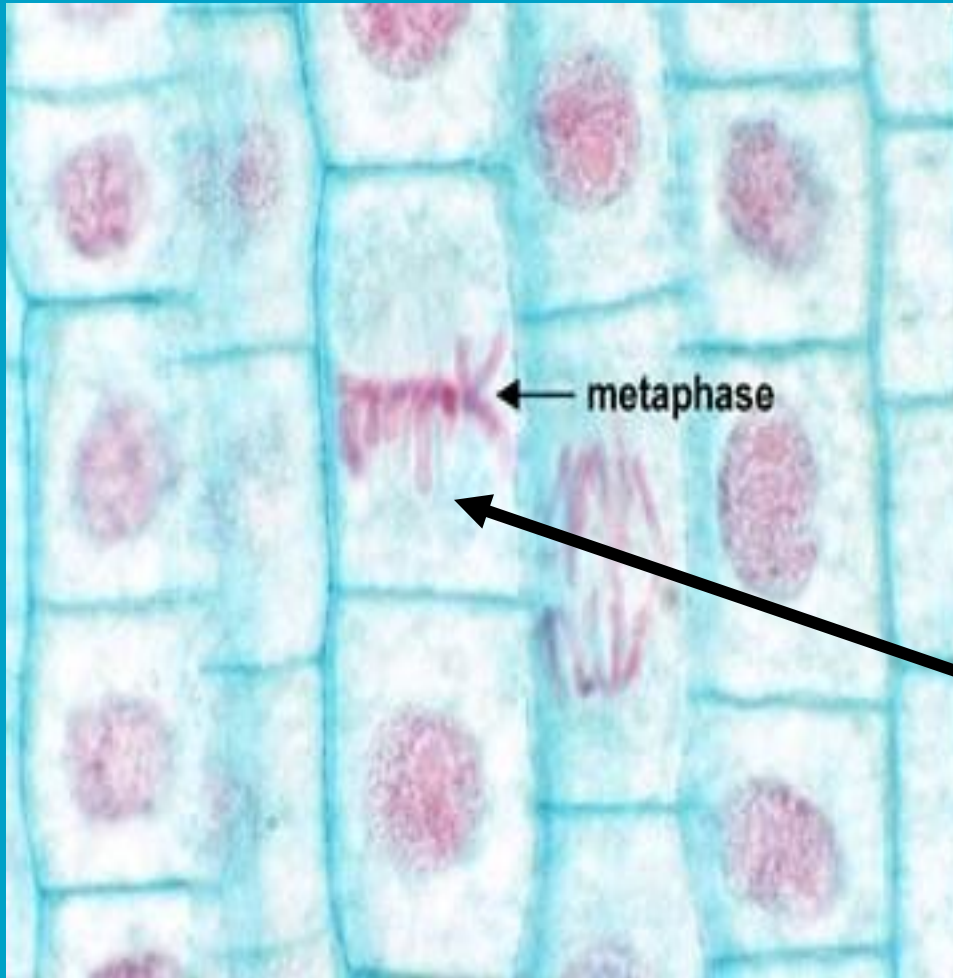
3. The chromosomes become visible

4. The spindle apparatus forms and attaches to the centromeres of the chromosomes



Metaphase

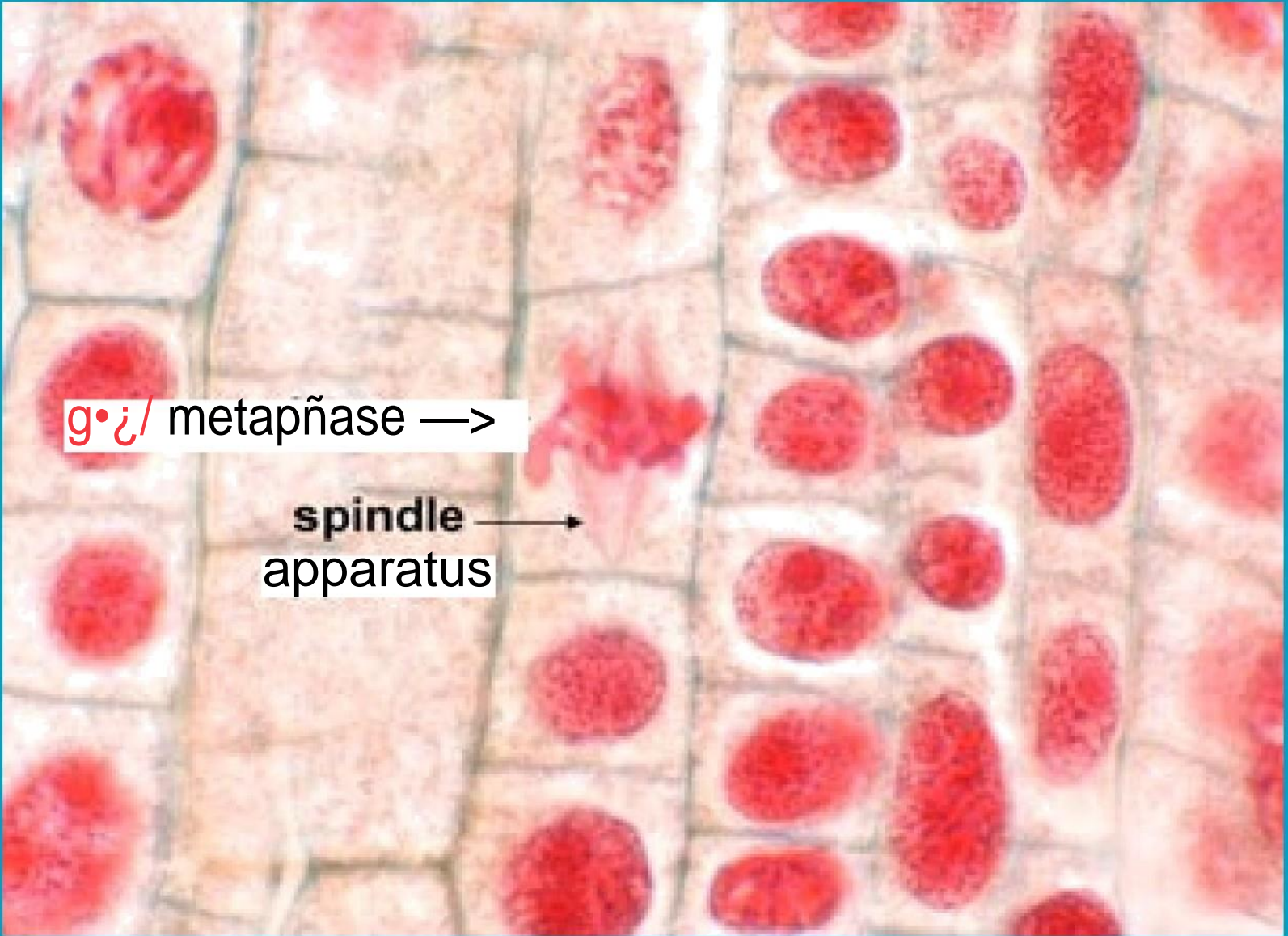
The Second Phase of Mitosis



4. The Nuclear Membrane is completely gone
2. The duplicated chromosomes line up along the cell's equator.

g.¿/ metapñase →

spindle
apparatus →



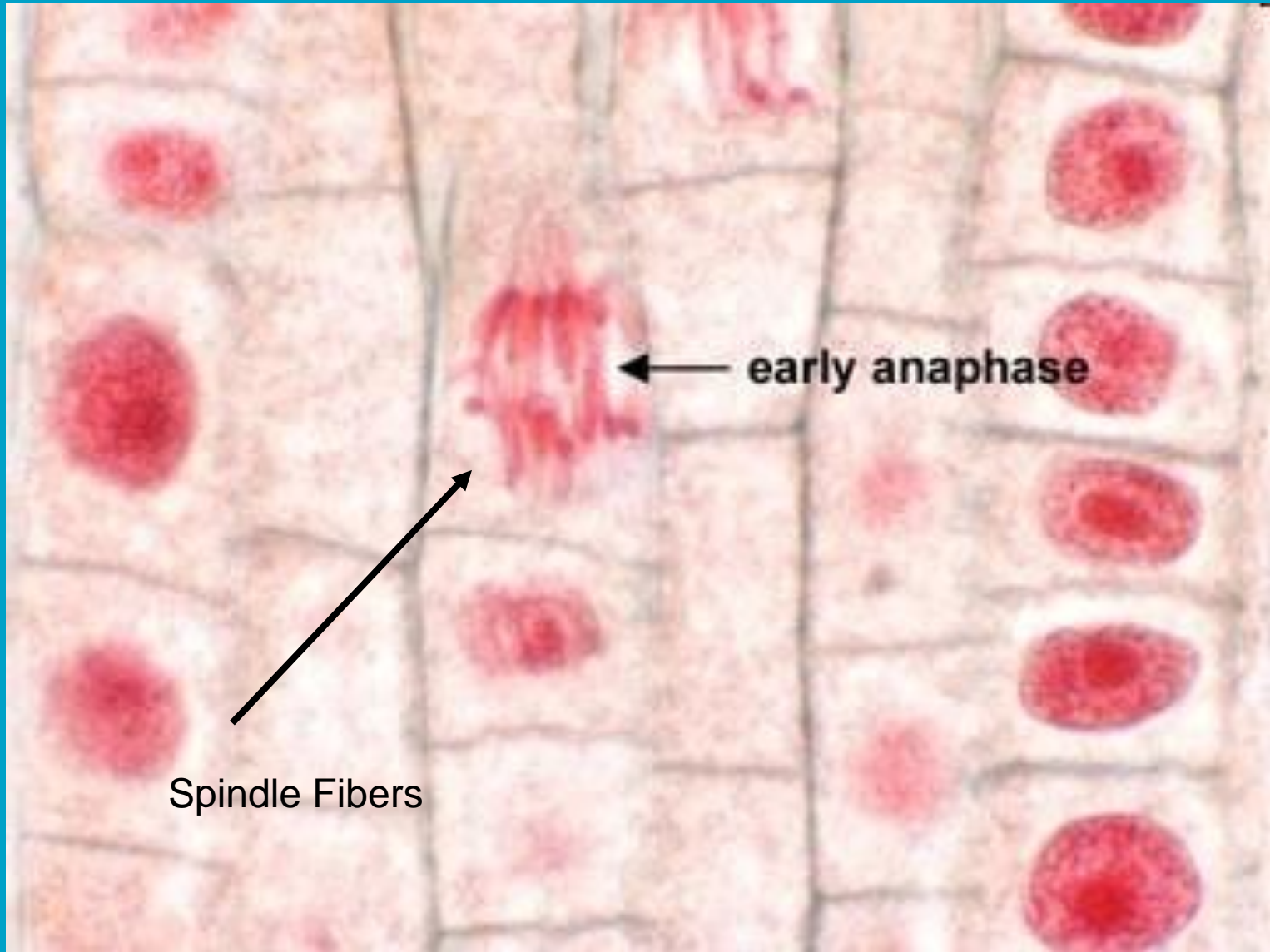
Anaphase

The third phase of Mitosis

Diploid sets of daughter chromosomes separate

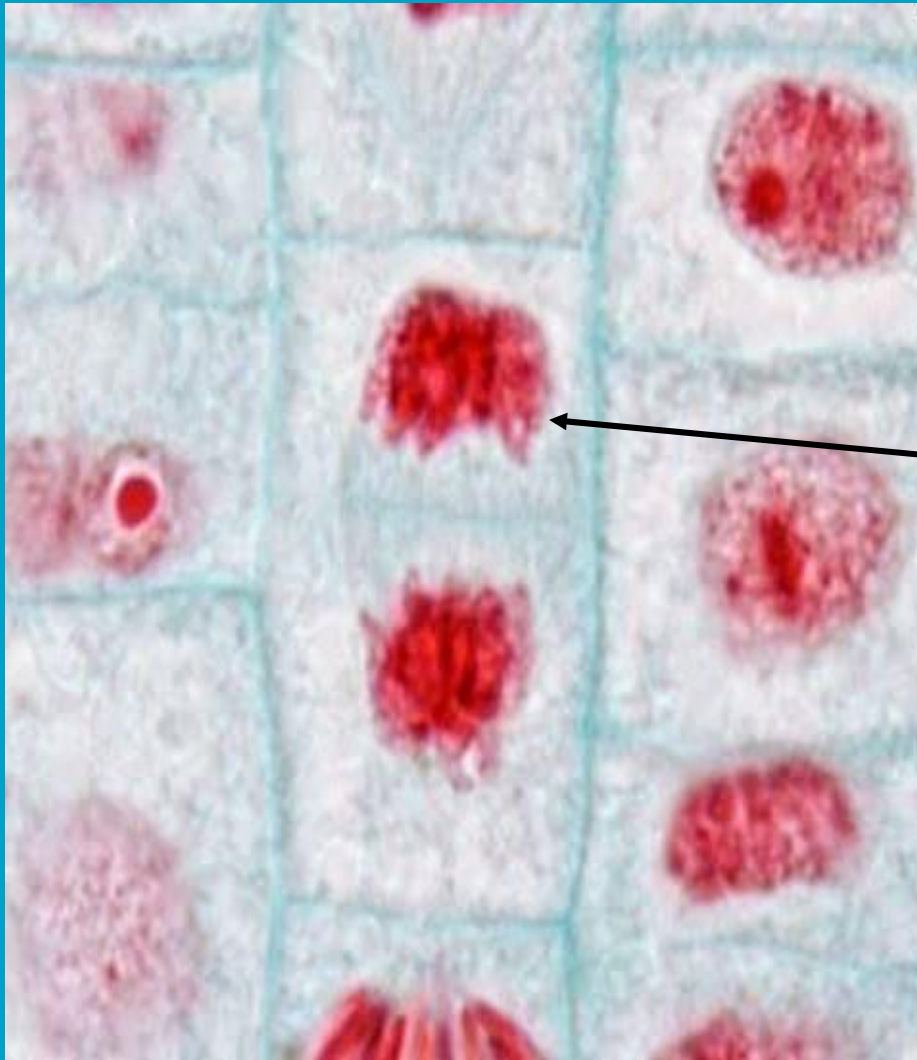
They are pushed and pulled toward opposite poles of the cell by the spindle fibers





← early anaphase

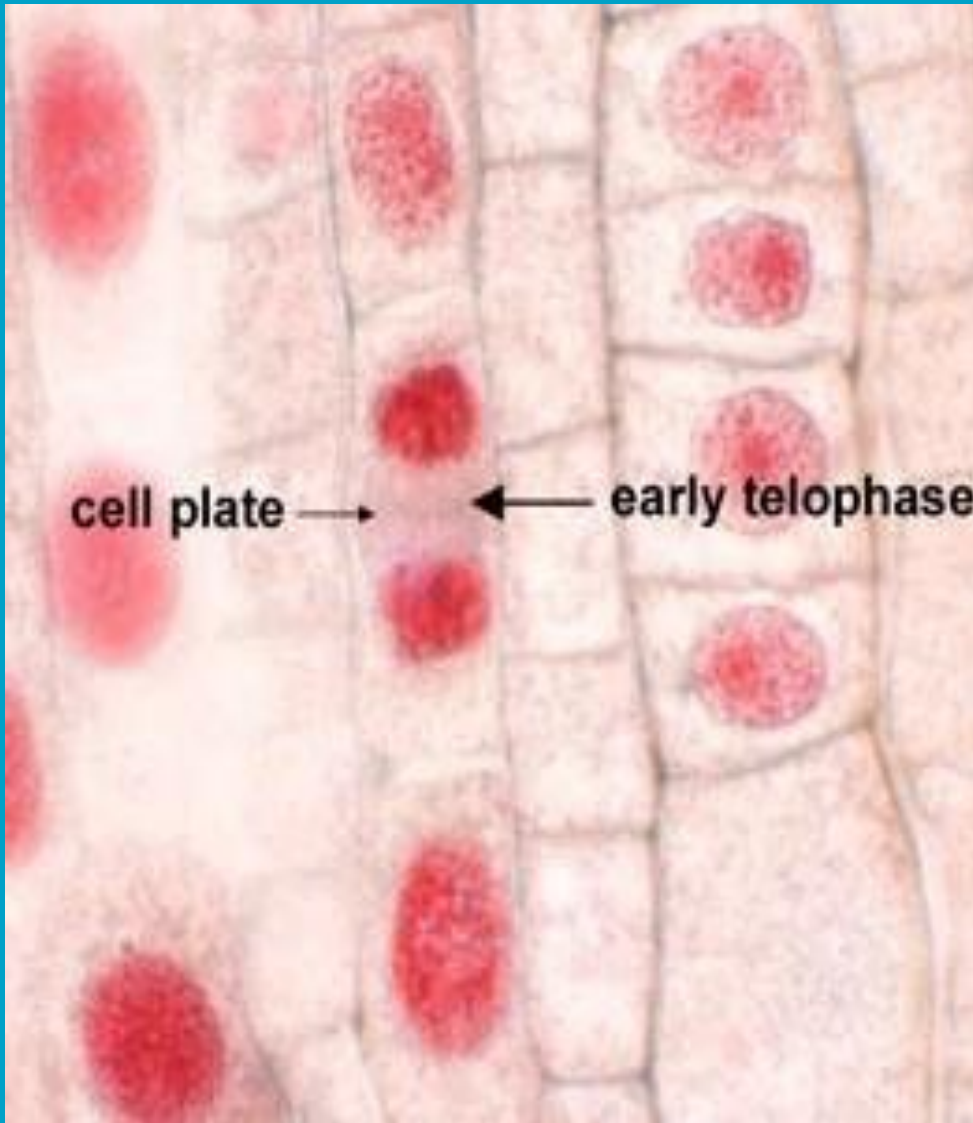
Spindle Fibers



Telophase

The nuclear membrane and nucleoli (nucleus) reform.

Cytokinesis is nearly complete,



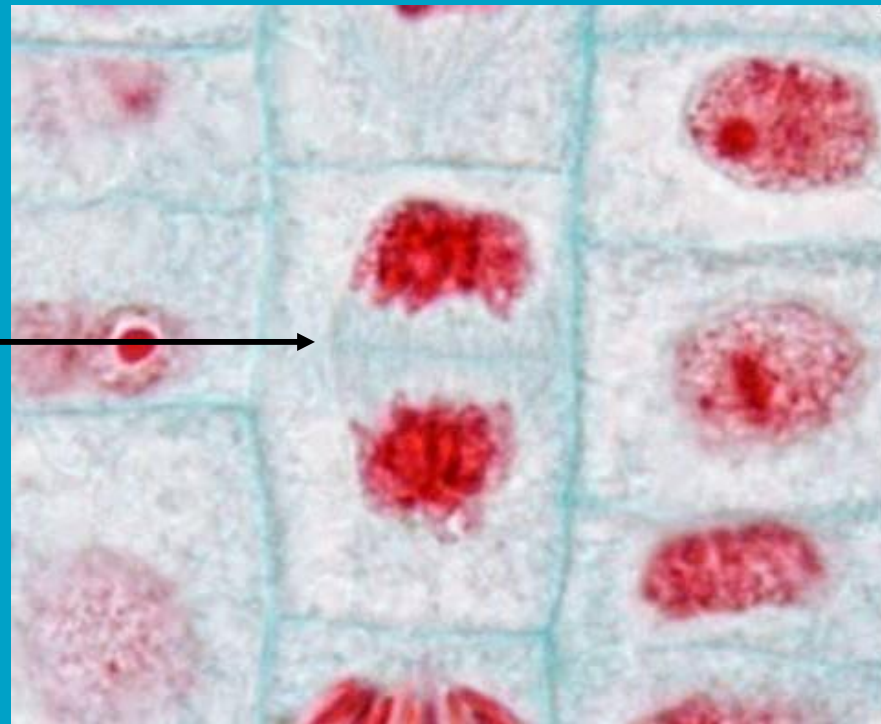
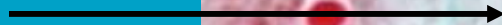
The Cell Plate
begins to form

The Cell
prepares for
final division

Cytokinesis – The final stage of Mitosis

The cytoplasm, organelles, and nuclear material are evenly split and two new cells are formed.

Cell Plate

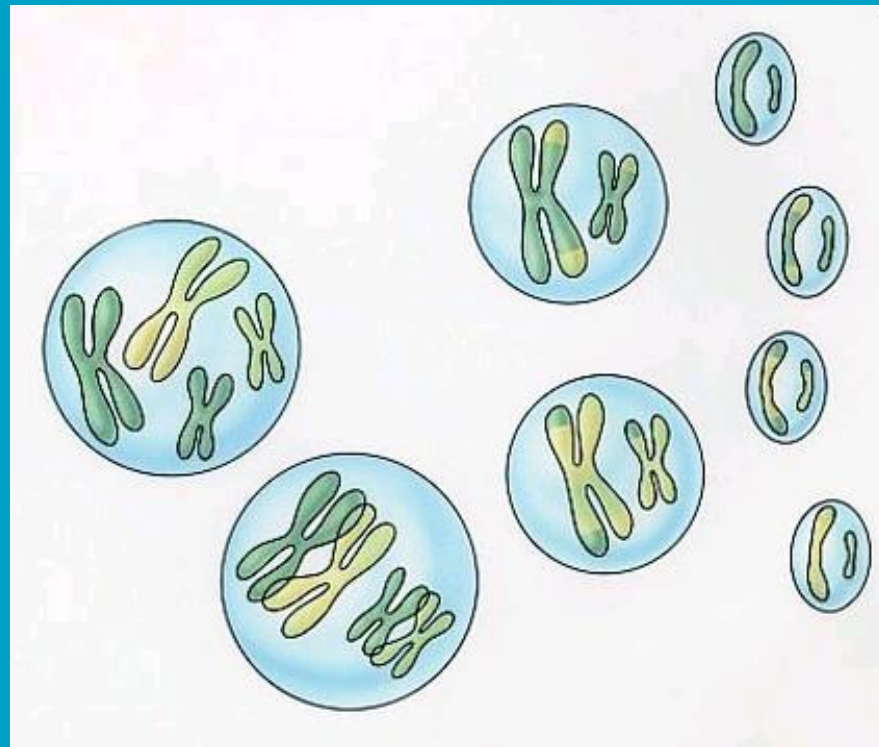


The two new cells – each exactly like the other – are called Daughter Cells

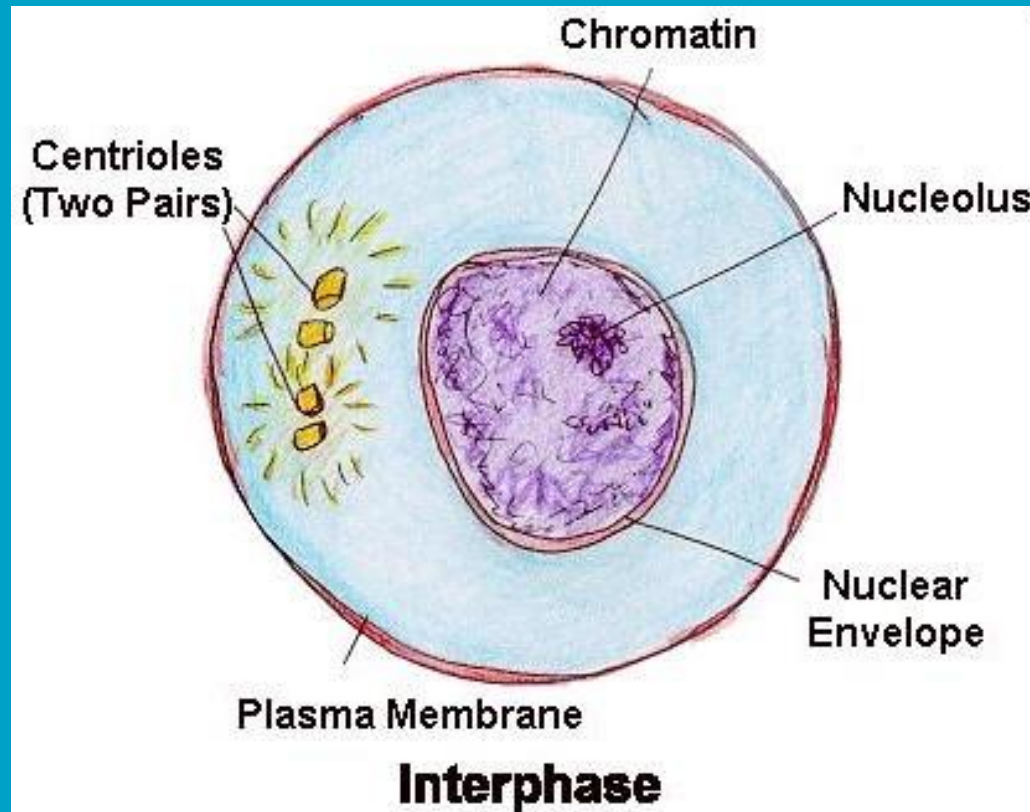


Quick Review:

The following slides are drawings of the stages of Mitosis. On your notes, please draw each phase and label it.

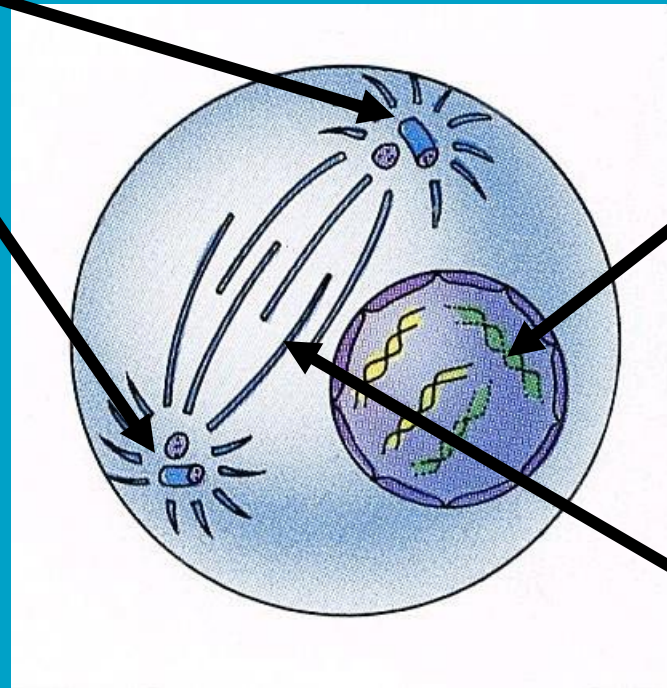


Interphase – The Cell spends the majority of its life here, growing and functioning. During the S Phase of the Cell Cycle, the DNA replicates, in anticipation of Mitosis



In Early Prophase of Mitosis the Chromosomes get small, centrioles move to the poles of the nucleus, and spindle fibers develop

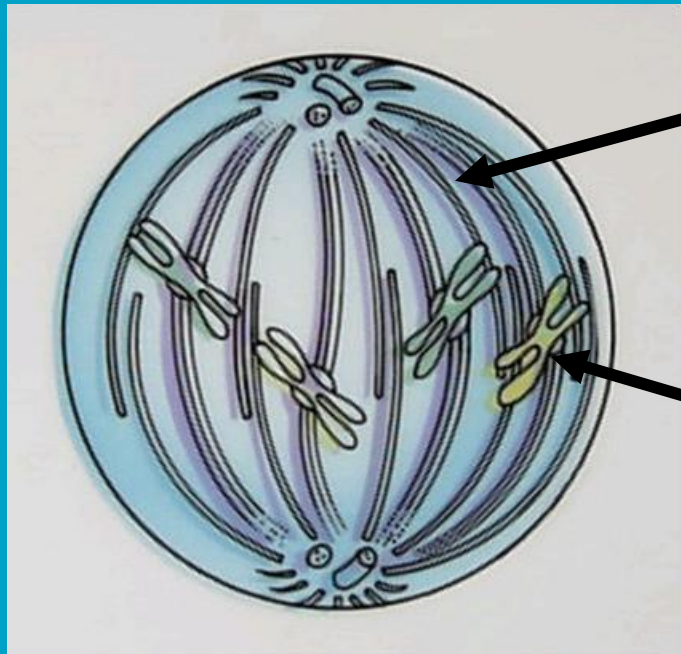
Pair of Centrioles



Chromosomes consisting of 2 Sister Chromatids

Spindle Fibers

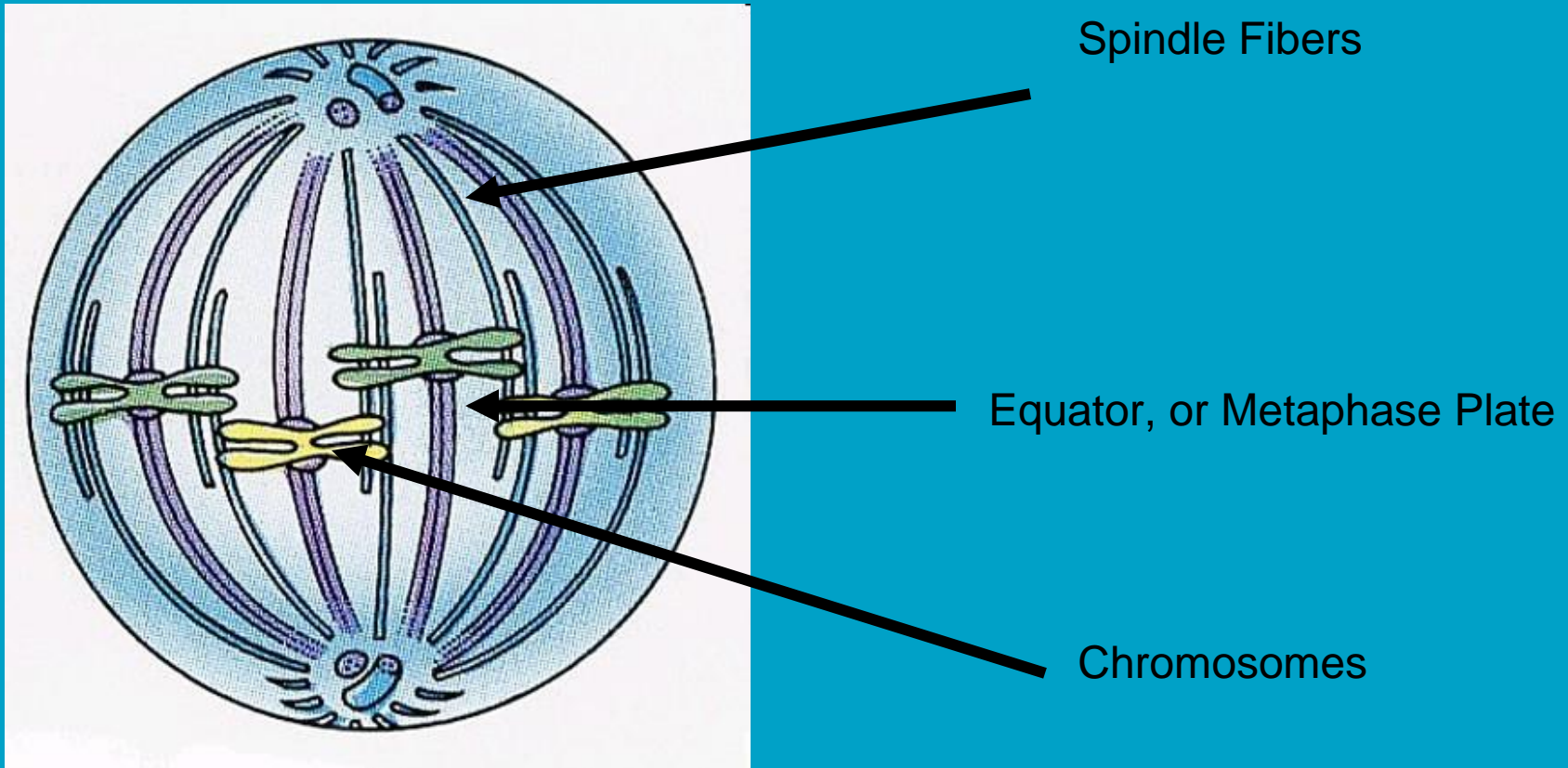
Late Prophase happens when the Nuclear Envelope disintegrates and spindle fibers begin to move Chromosomes toward the center of cell.



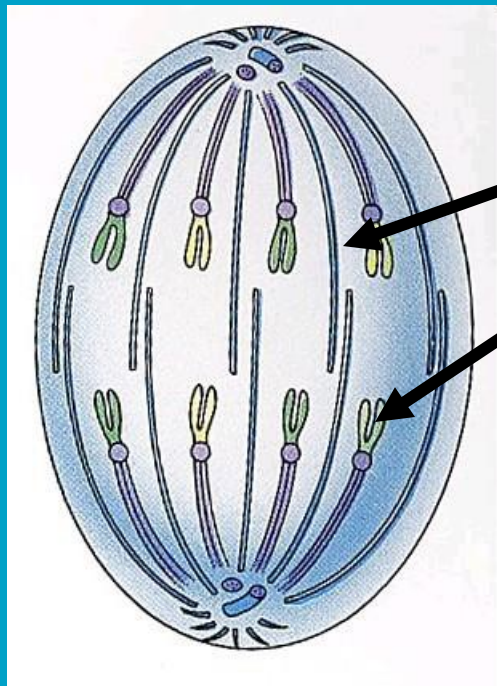
Spindle Fibers

Chromosomes

During Metaphase the Chromosomes line up across center of the cell, also called the equator, or Metaphase plate.

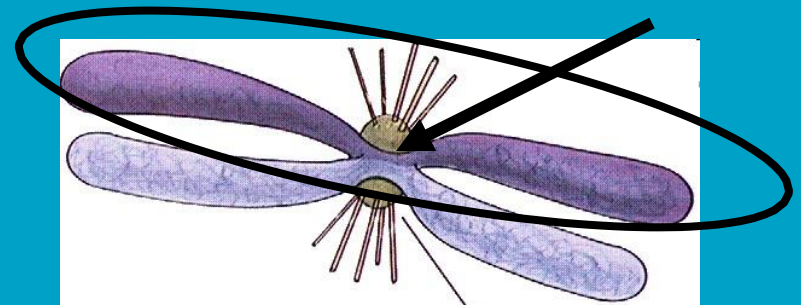


In Anaphase the Chromatids that make up each Chromosome move apart and travel to opposite ends of cellular spindle



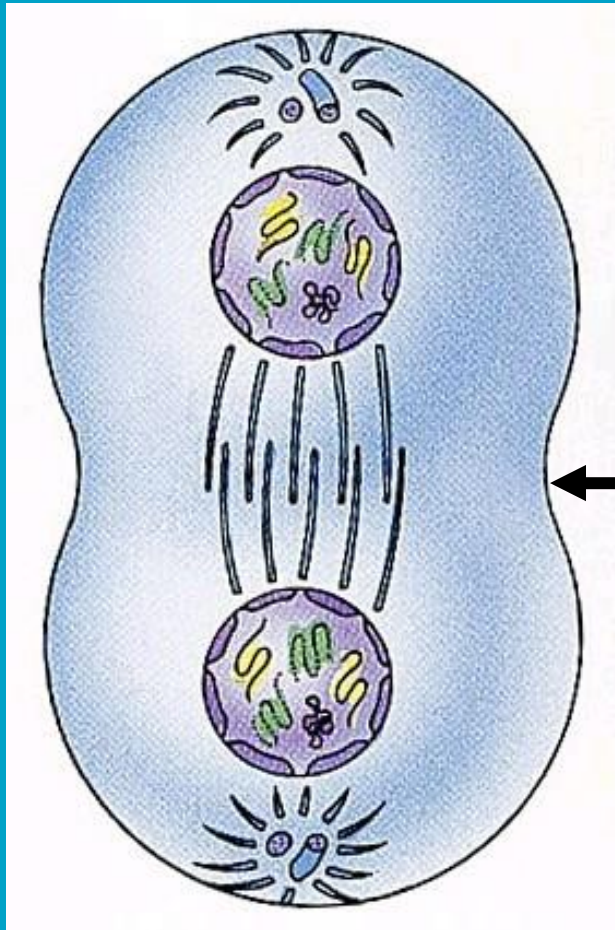
Daughter Chromosomes

Chromatid



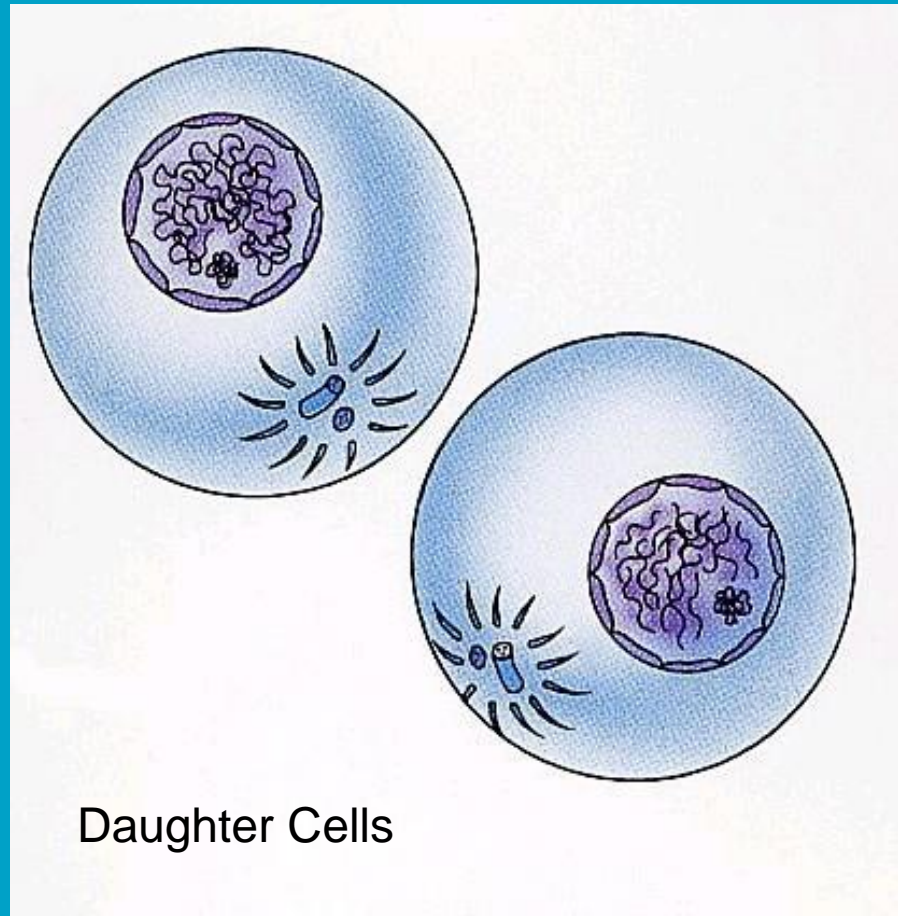
Chromosome

In Telophase an envelope surrounds each set of Chromatids to form new Nucleus and the Cytoplasm starts to divide

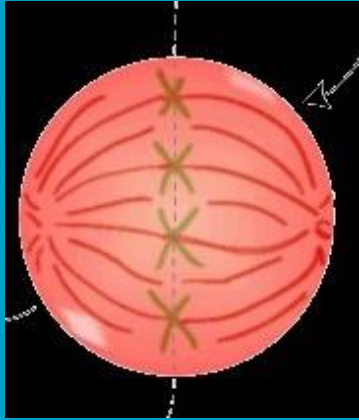


Cleavage Furrow

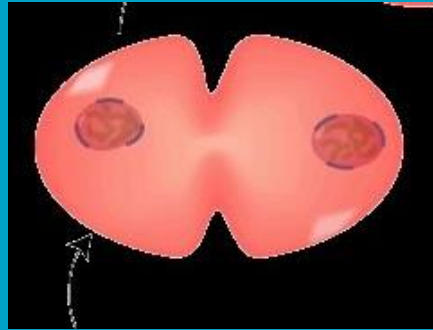
Cytokinesis takes place when the Cytoplasm divides and two cells with identical genetic material are formed



Quick Review – Place Cells in Mitosis Order



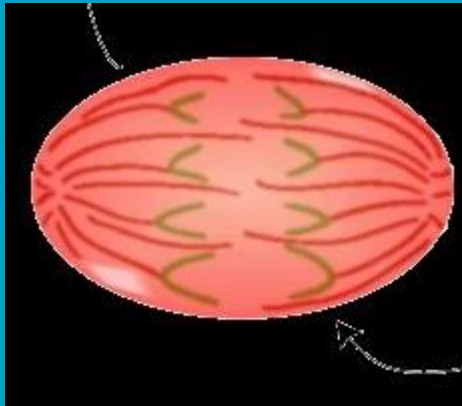
A



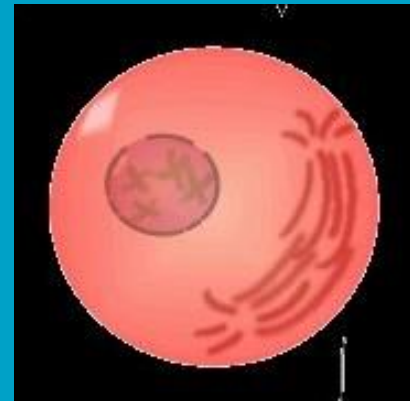
B



C



D



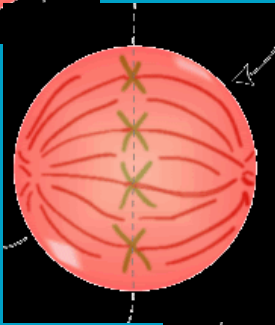
E



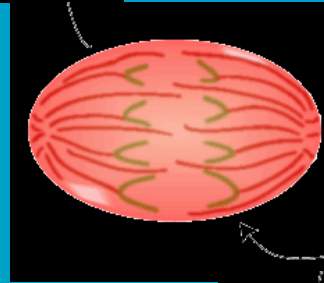
Interphase



Prophase



Metaphase



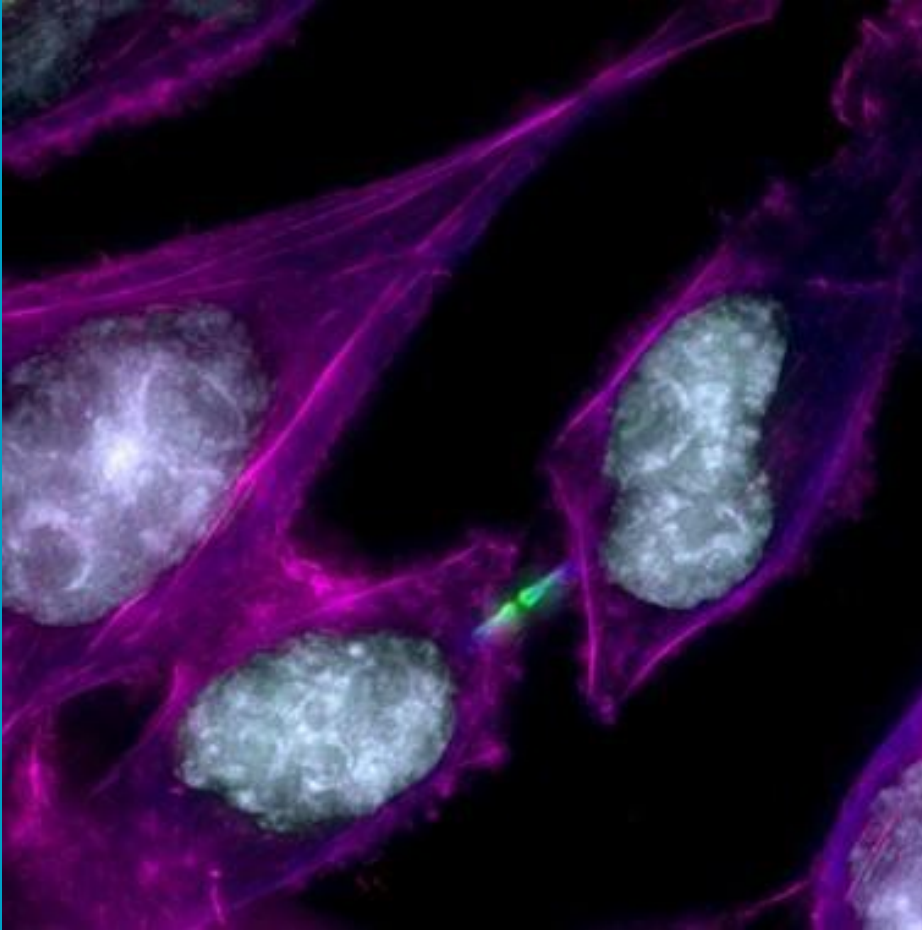
Anaphase



Telophase

Quick Review:
Identify What
happens in each
phase of Mitosis:

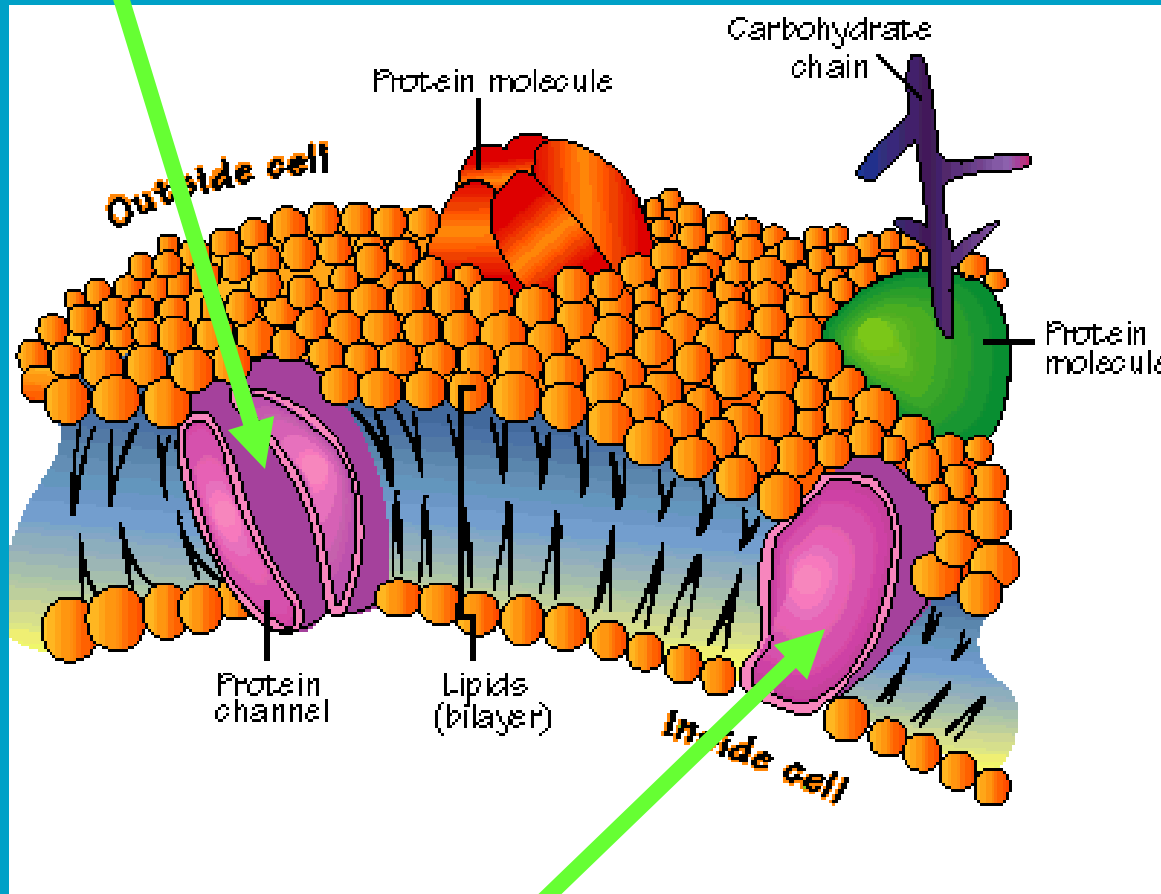
Why Do Cells Divide?



The larger a cell becomes, the more demands the cell places on its DNA.

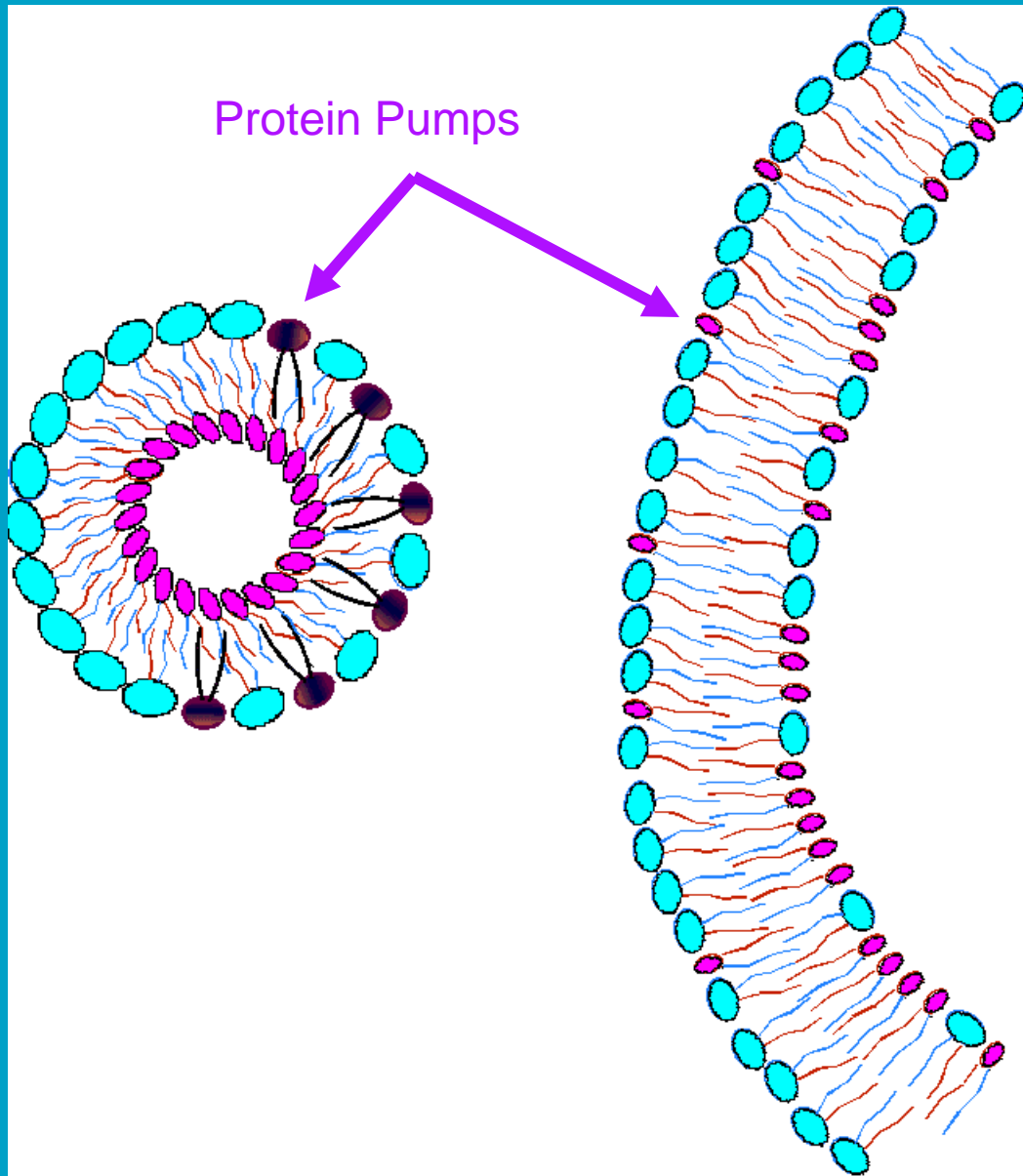
It also has more trouble moving enough food and wastes across its cell membrane.

Food goes in

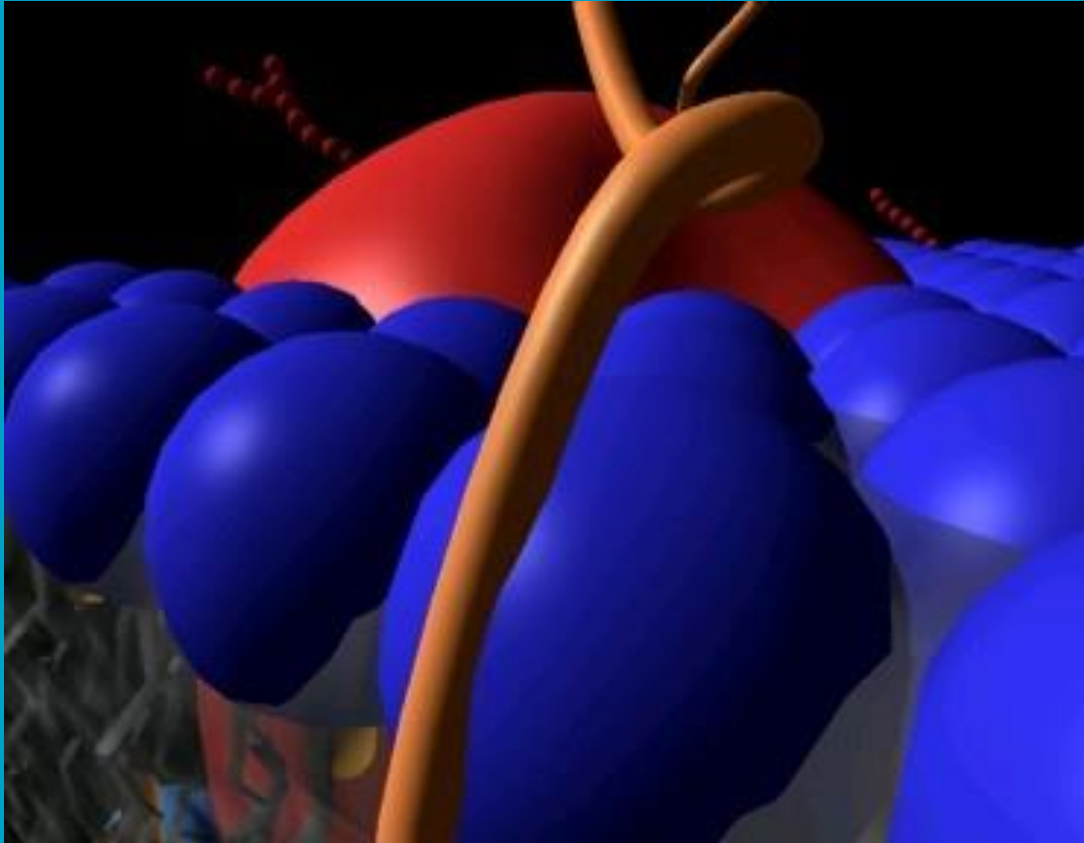


Waste goes out

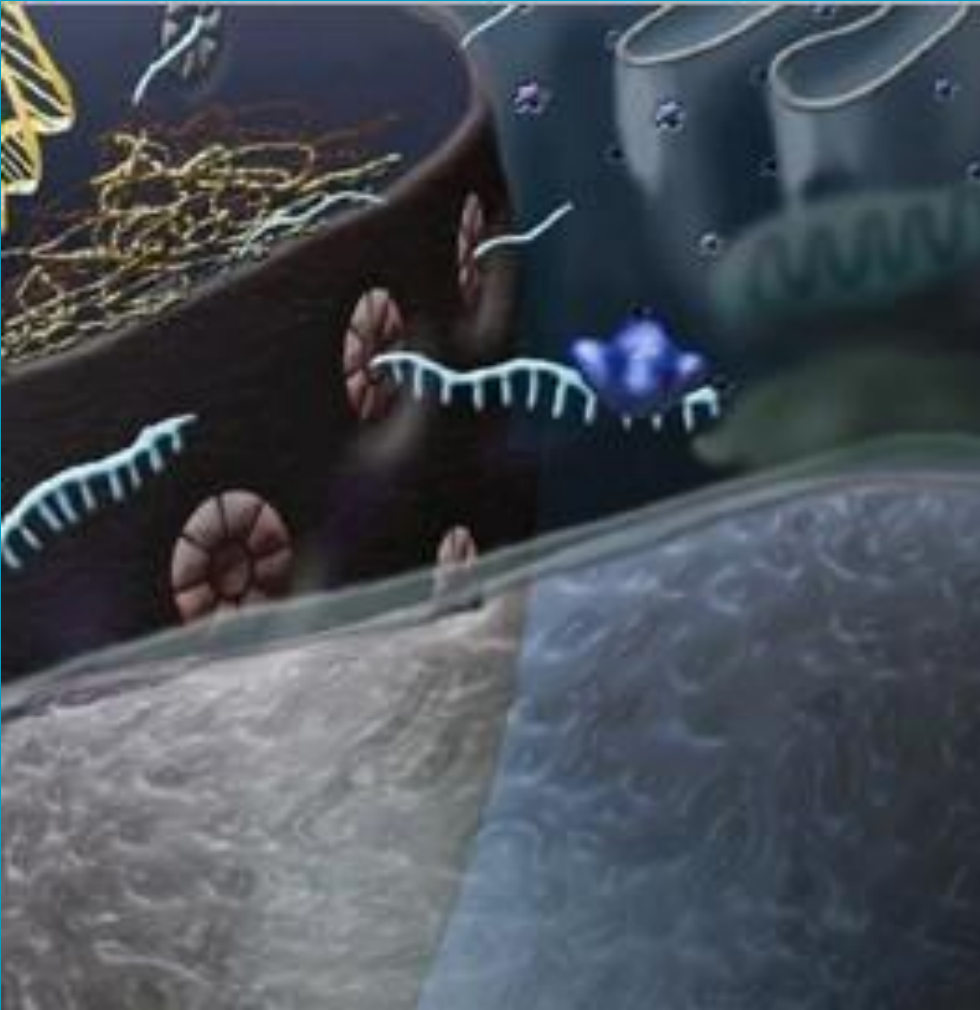
The bigger the cell gets the harder it becomes to move food and waste across the membrane



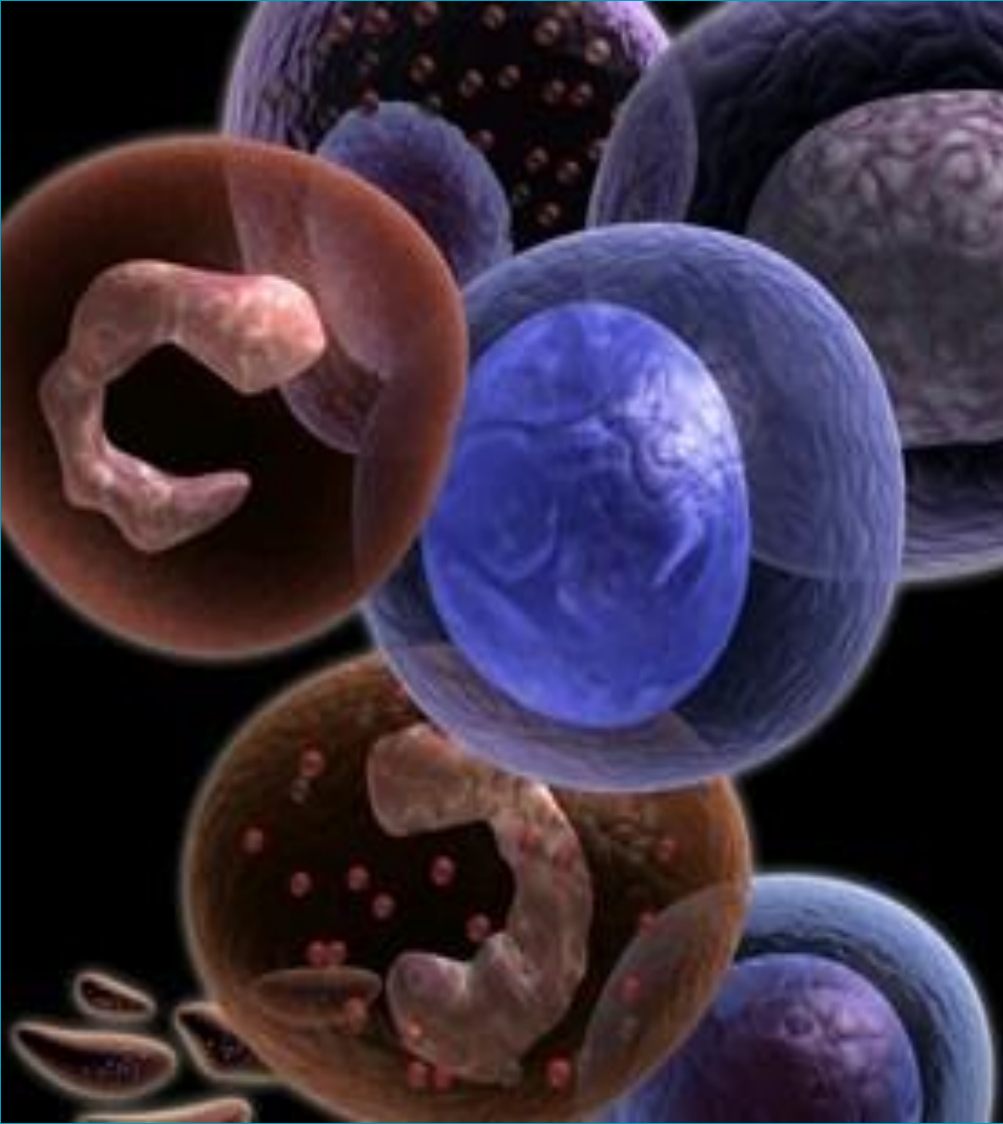
This happens because the **surface area** and **volume** ratio does not stay the same as the cell size increases.



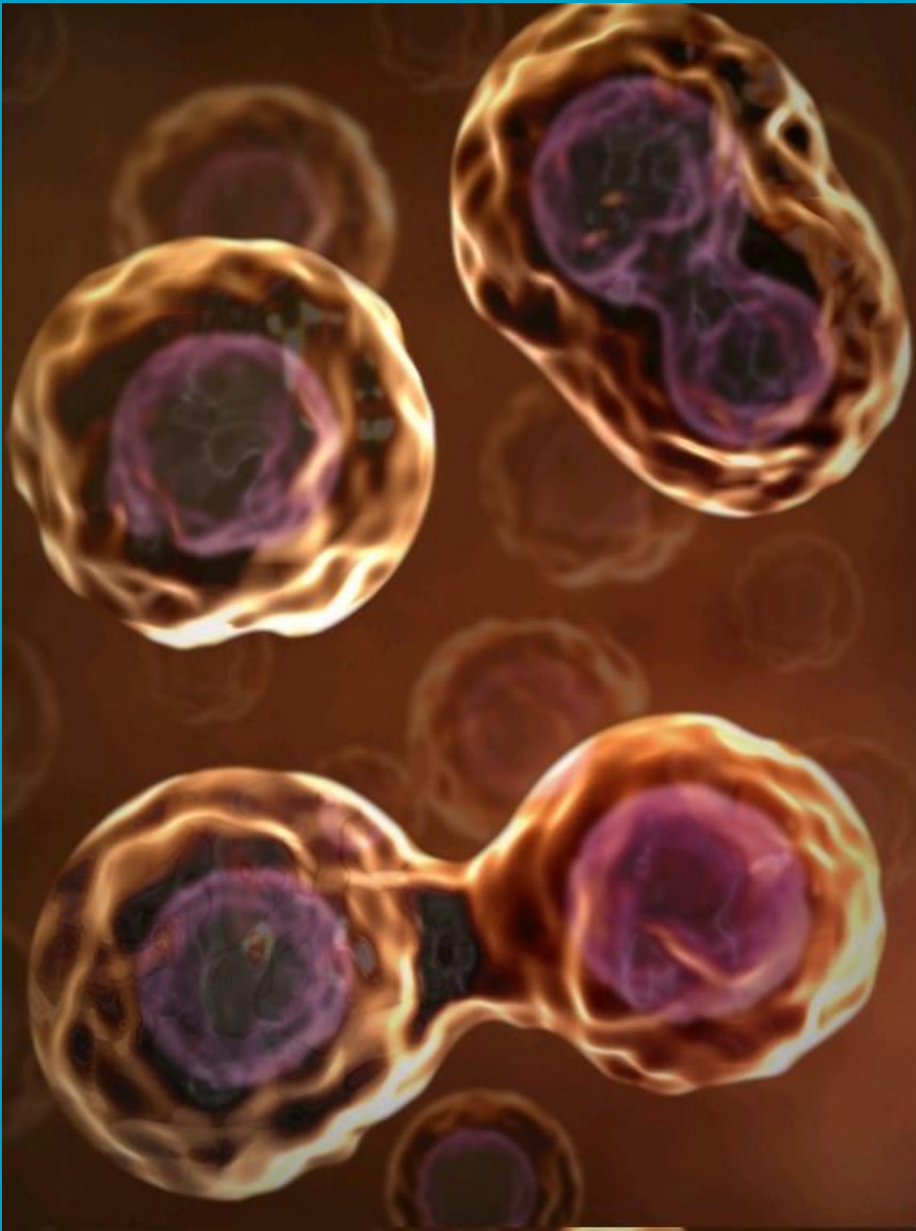
The cell's ability to either get substances from the outside or eliminate waste from the inside is related to the **surface area** of the cell membrane.
(outside)



How much food and other material is required, and how much waste the cell produces and has to get rid of, is related to the **volume** of the cell. (inside)



As a cell gets bigger there comes a time when its surface area is not large enough to meet the demands of the cell's volume and the cell stops growing.



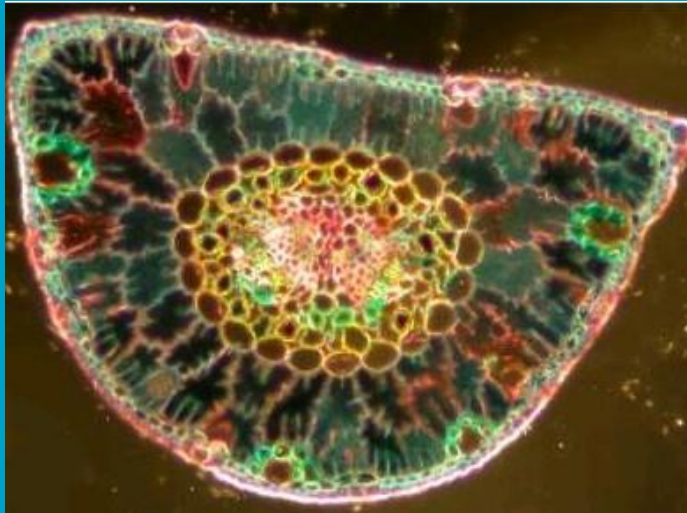
So, once cells reach a certain size they must divide in order to continue to function – or they will no longer be able to take in nutrients and eliminate waste.

Why Is Cell Division Important?

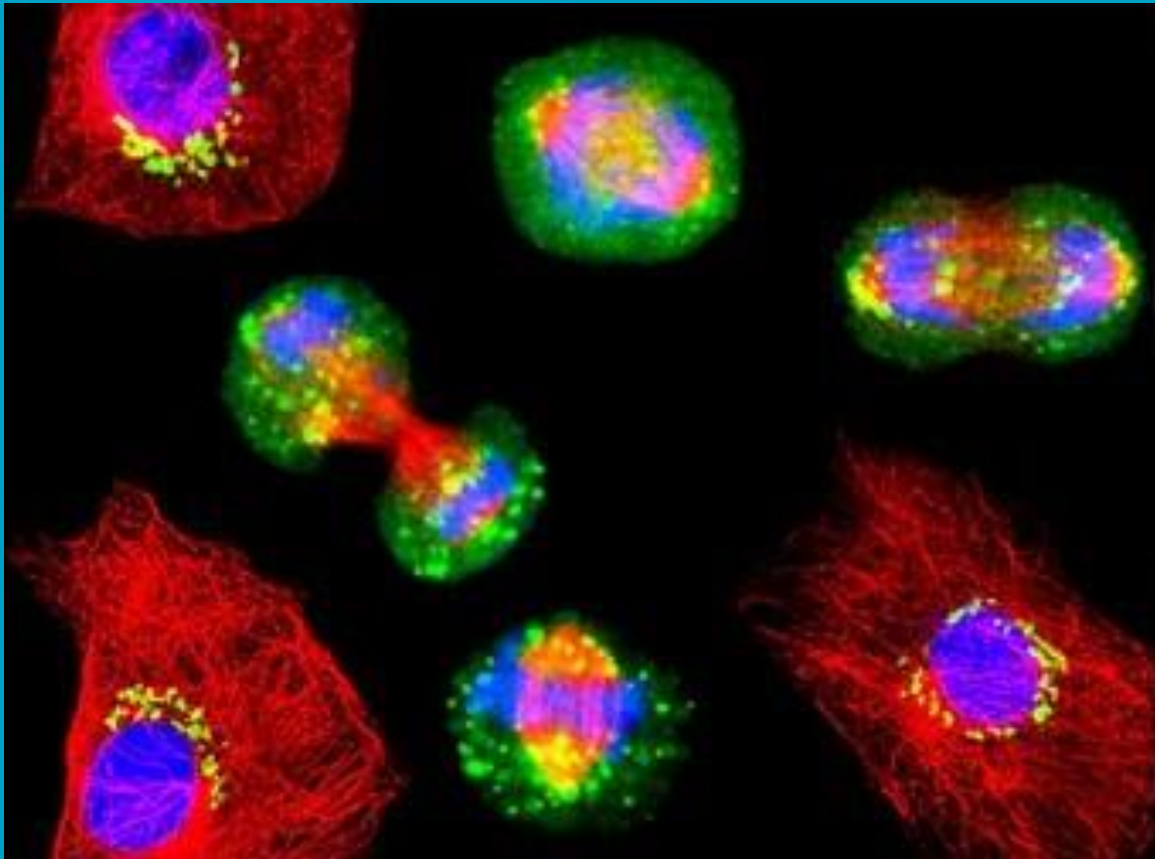
1. All Living Things are made of Cells



2. The Cell is the basic unit of Structure and Function in Living Things.



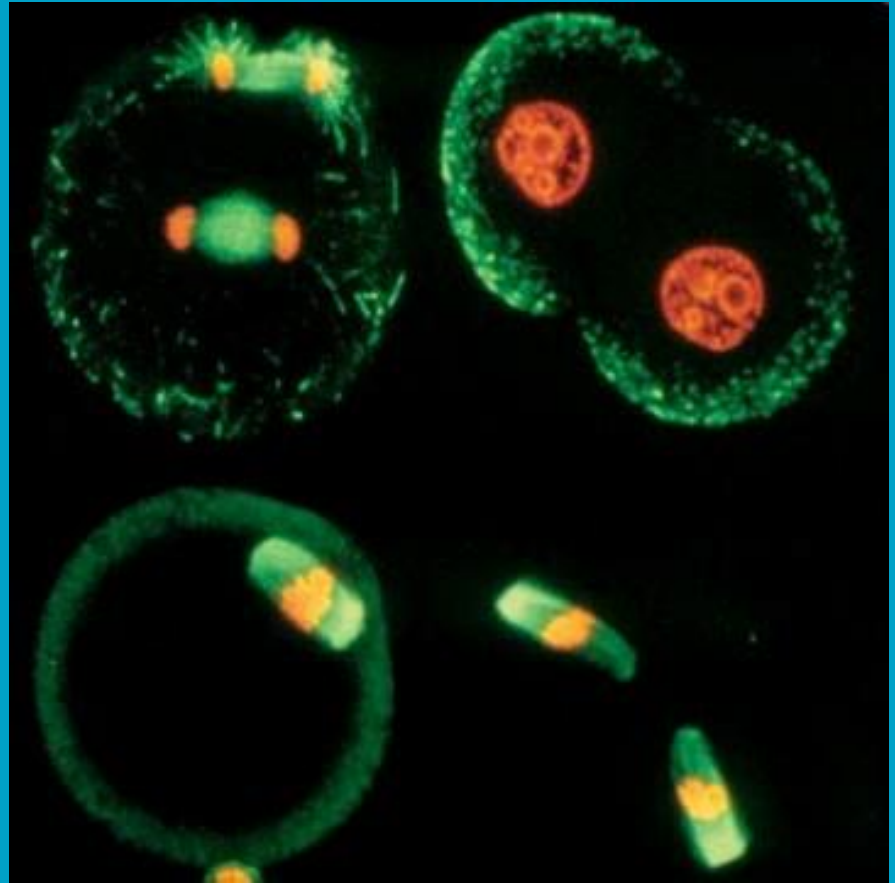
3. All Cells come from pre existing Cells

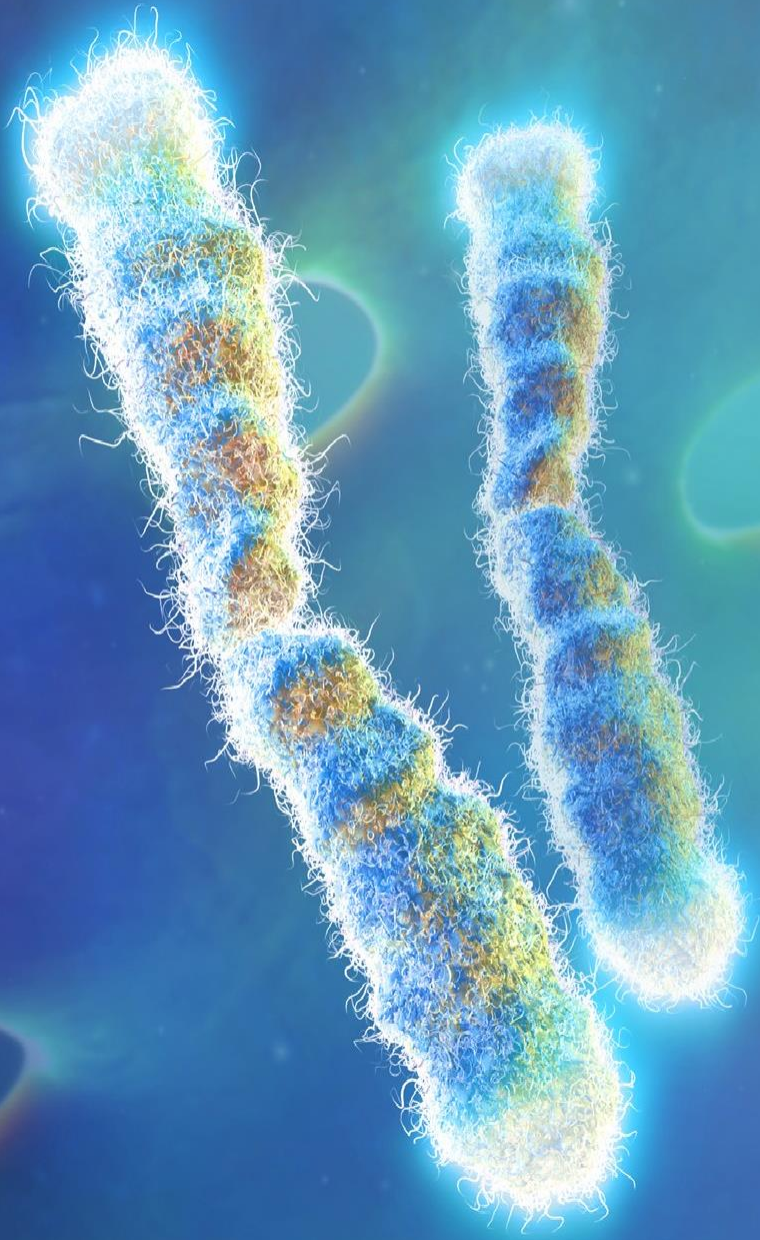


You are a living organism, made of cells.

In order to keep living, your cells must stay alive.

In order for cells to keep living, they must divide and multiply





Meiosis

Why We Are Who We Are

Meiosis

Takes place in the Gametes of an organism

People have a Chromosome count of 46

When an egg joins a sperm the count must stay at 46 to remain human

So, the egg can only have 23 chromosomes, and the sperm can only have 23 chromosomes

But, the integrity of the organism must be maintained

How does this happen?



During Meiosis gamete (sex) cells undergo a “double division”, maintaining the DNA, but reducing the chromosomal count to 23



+



=



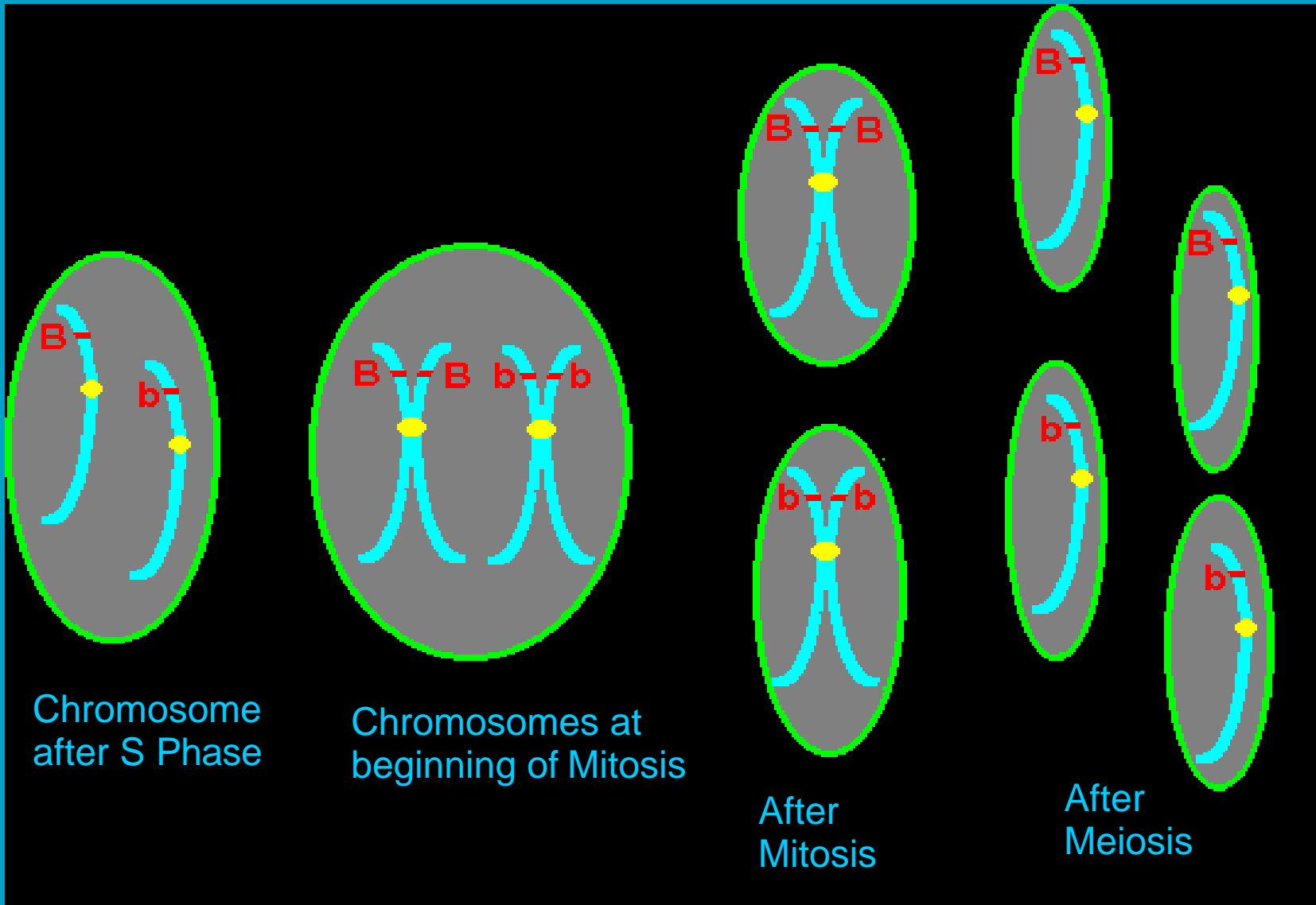
Sperm (23)

+

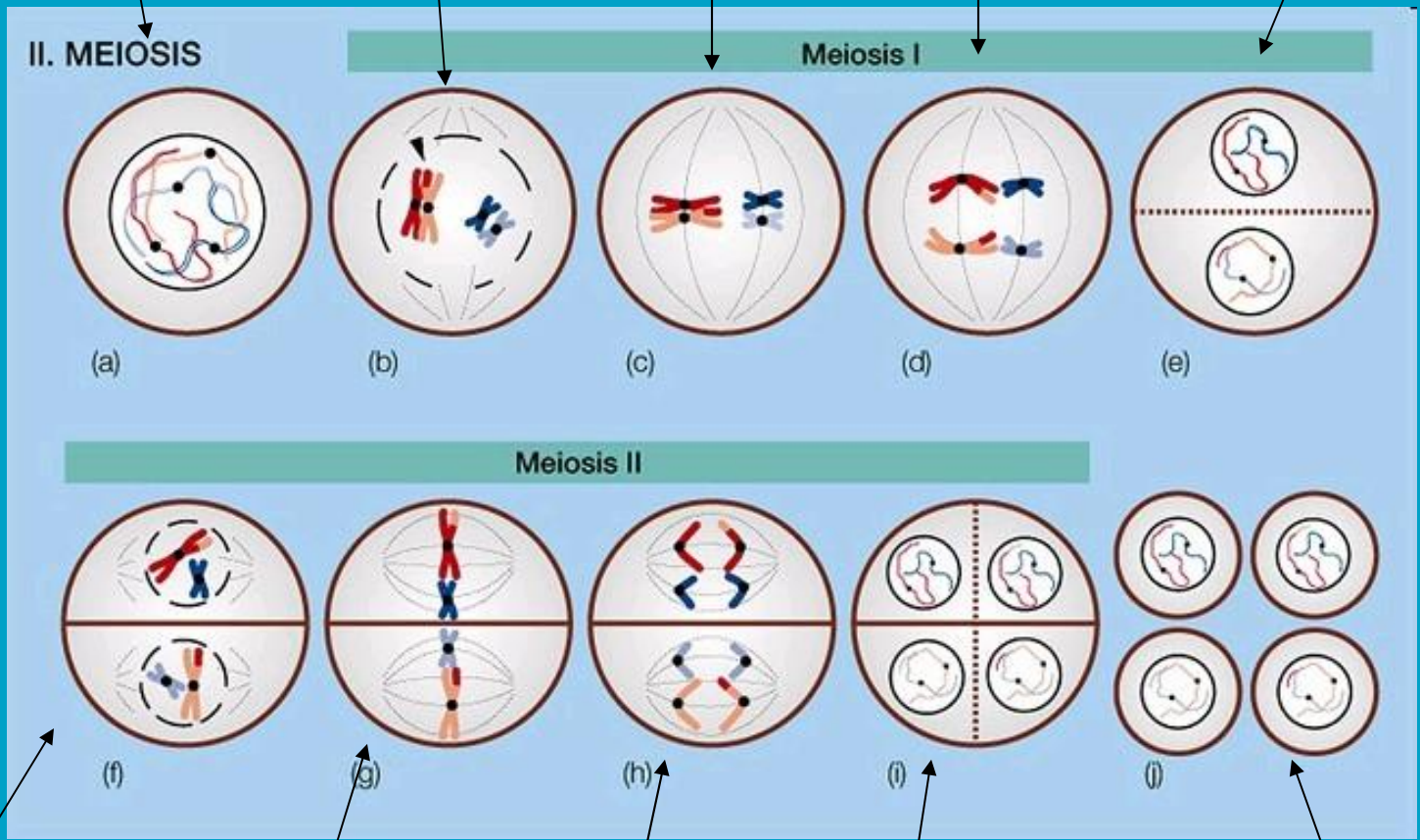
Egg (23)

=

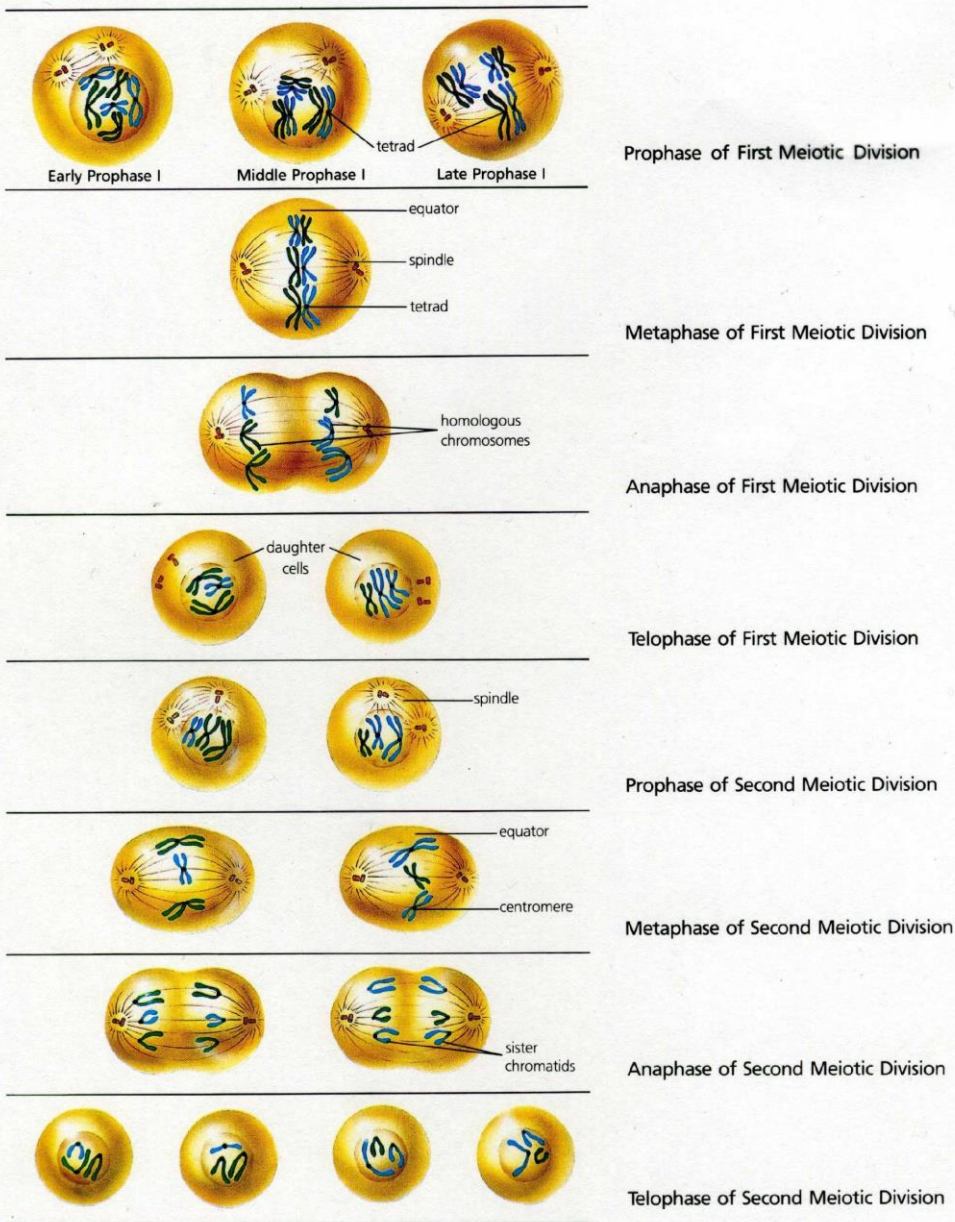
Fertilized Cell (46)



Original Gamete Metaphase Anaphase Telophase Cytokinesis



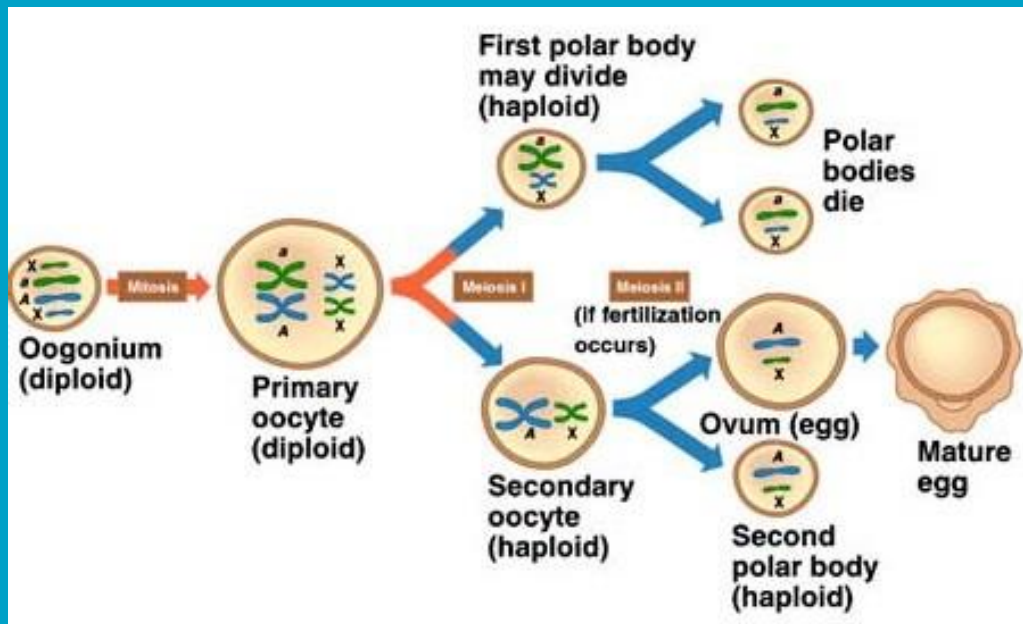
2 Daughter Cells Metaphase 2 Anaphase 2 Telophase 2 Cytokinesis – 4 Gametes



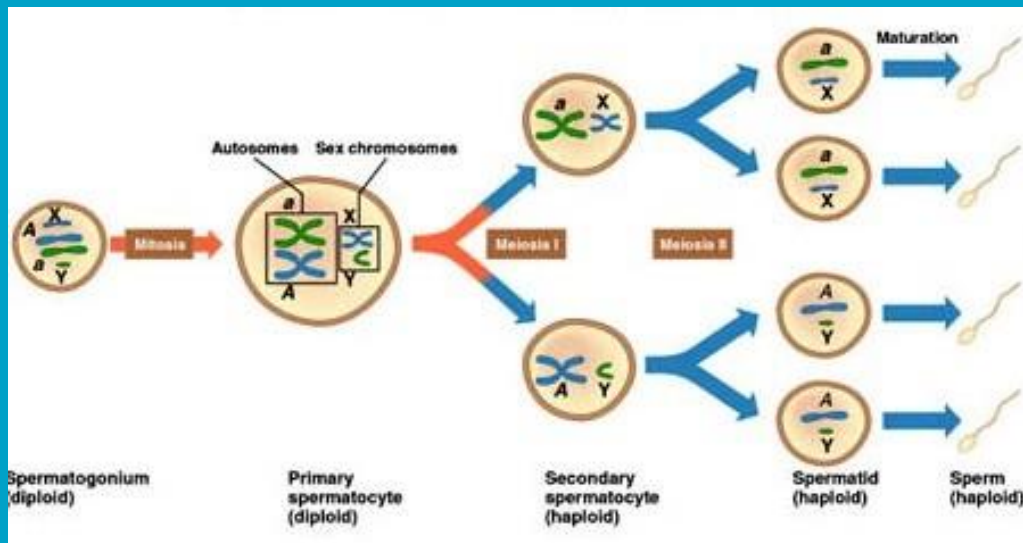
At the end of Meiosis the individual Gamete cell has divided from one cell to four.

Males produce 4 viable sperm.

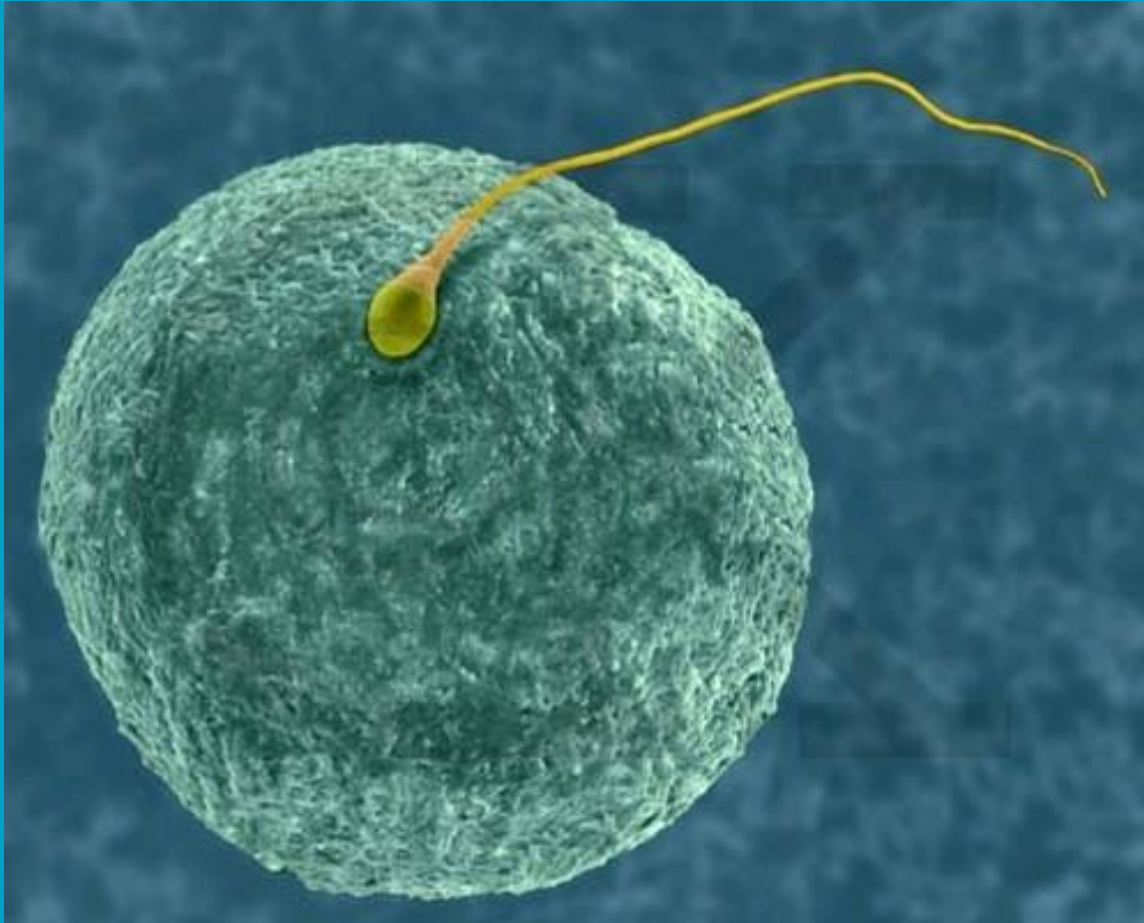
Females produce 1 viable egg and 3 non functioning polar bodies.



OOGENESIS



SPERMATOGENESIS



Meiosis
ensures that
all living
organisms
will maintain
both Genetic
Diversity and
Genetic
Integrity

- **Define:**
 - **chromosome**
 - **chromatin**
 - **gene**

- **Genome**

chromatin: long DNA molecule with associated proteins

chromosomes: densely packaged chromatin during cell division protects the DNA sets up DNA distribution

each chromosome contains hundreds to thousands of **genes**

- functional units of heredity
- typically instructions for a protein or RNA
- **genome** – organism's complete DNA sequence
- humans apparently have ~25,000 genes in the now-sequenced human genome