

UNIT 4

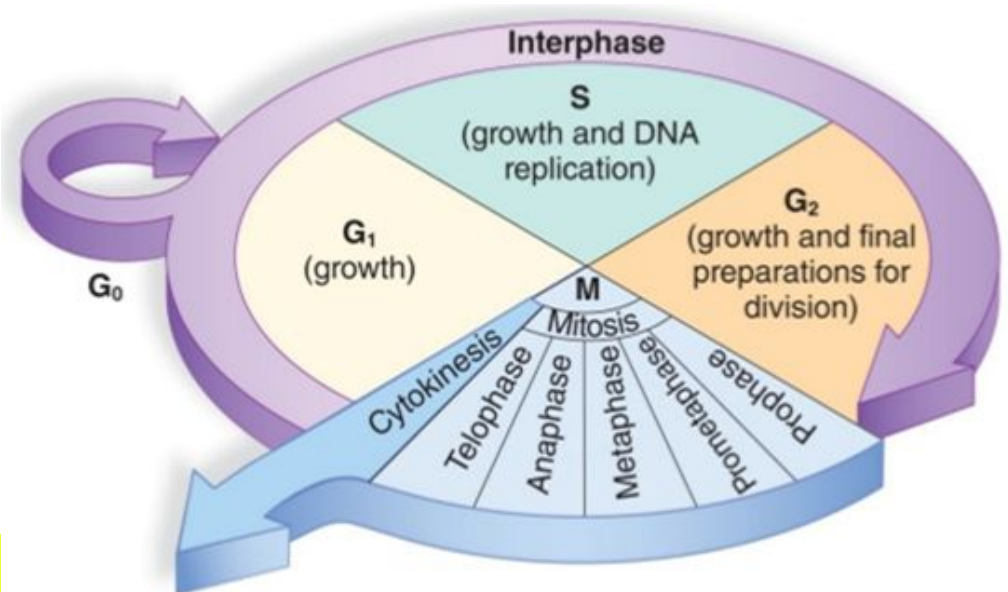
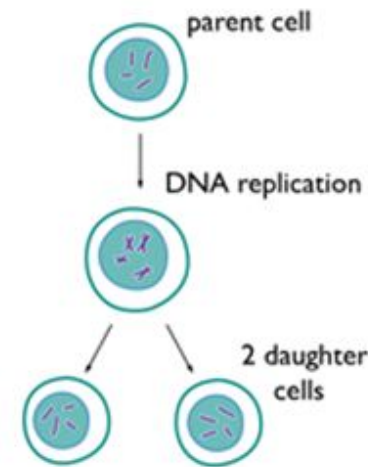
Cell Cycle

What is the cell cycle?

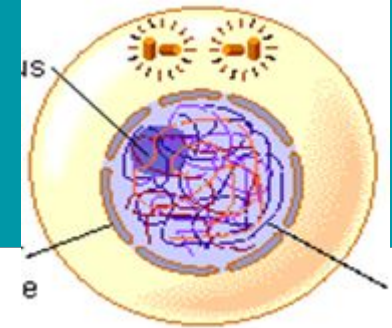
- Continuous sequence of growth and division of a cell
- For growth and repair
- During the Cell Cycle, a cell divides to form 2 identical daughter cells from one parent cell

3 stages:

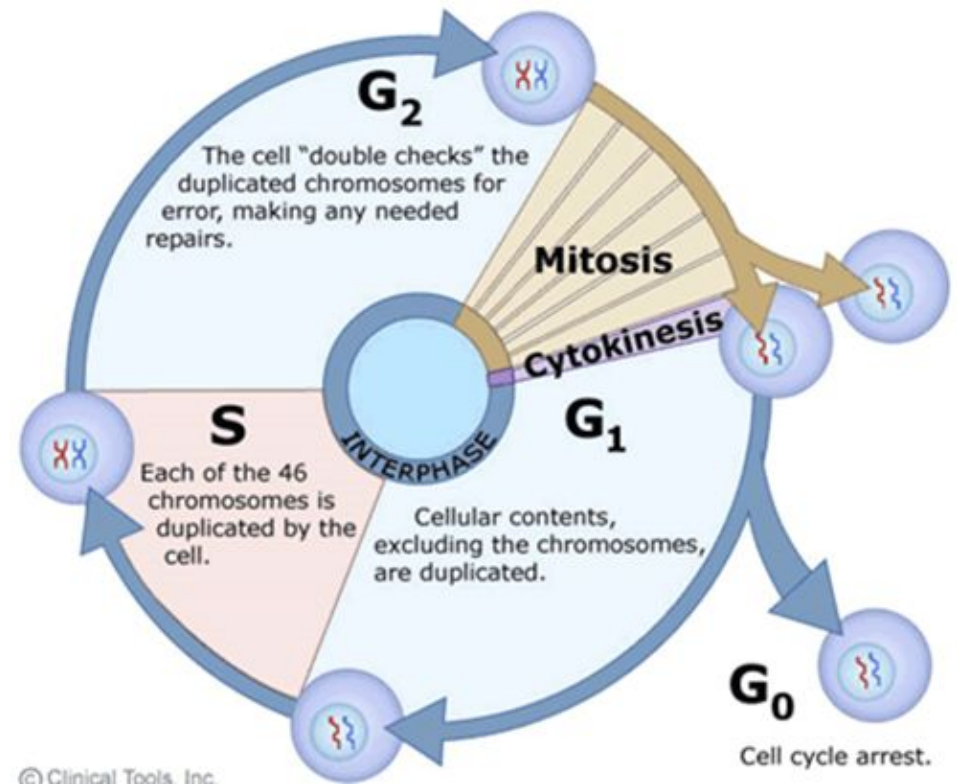
- Interphase (I)
- Mitosis (PMAT)
- Cytokinesis (C)



Interphase

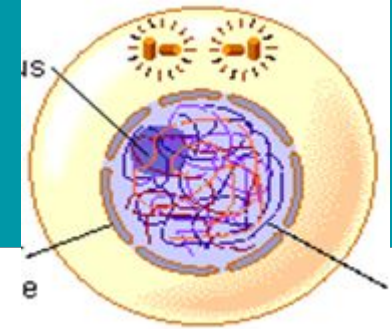


- Longest phase
- The period of growth that occurs between cell division
- Interphase is divided into three phases: G₁, S, G₂



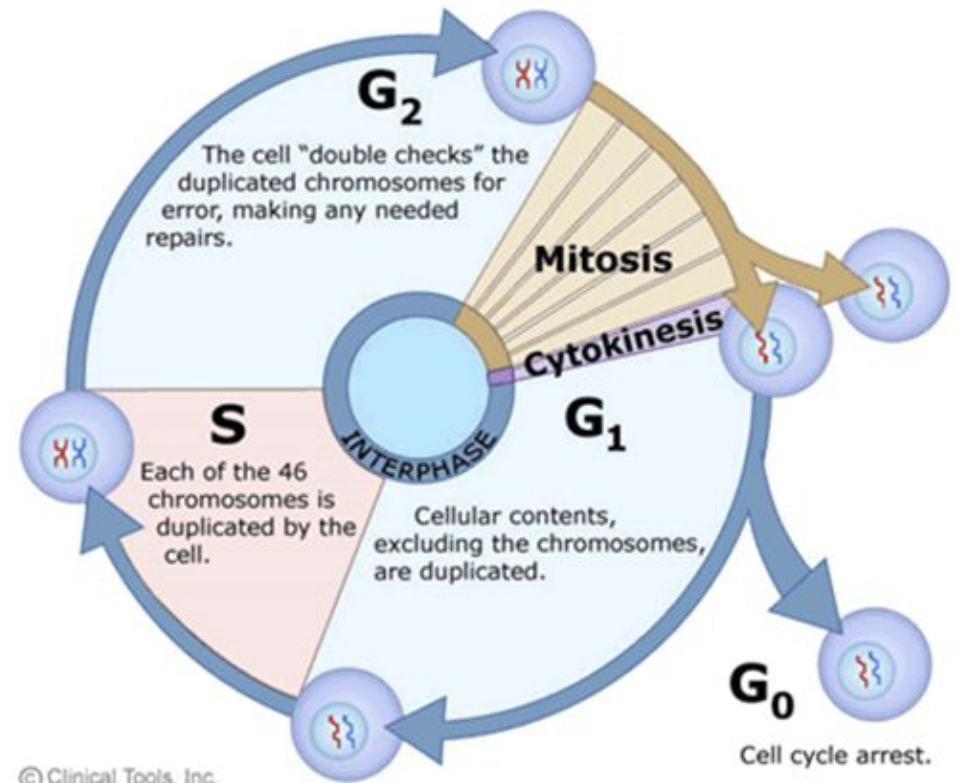
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G₁ & S Phase



- **G₁ Phase:** period of activity in which cells do most of their growing. Cells increase in size and synthesize (build) new proteins and organelles.

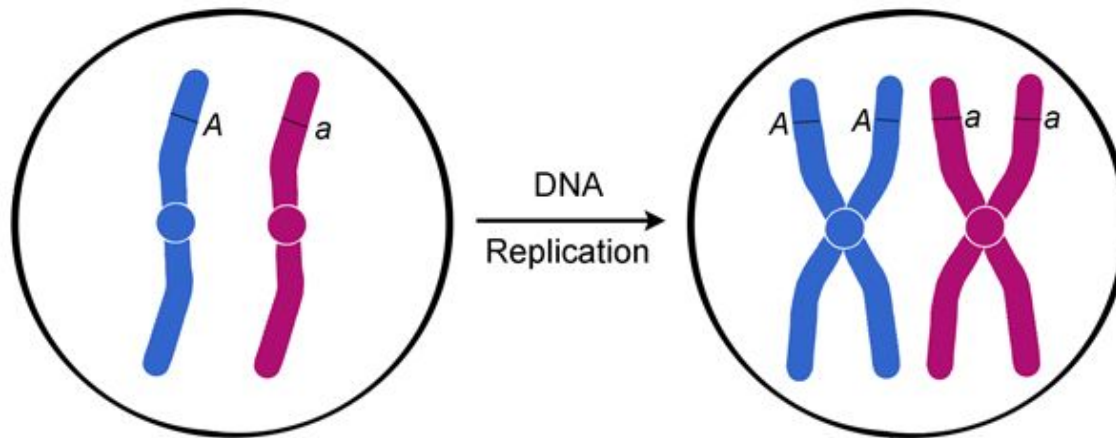
- **S Phase:** replicates chromosomes and synthesizes DNA. When DNA replication is completed, the cell enters the G₂ phase.



DNA Replication

(S) phase - Interphase

S stands for synthesis



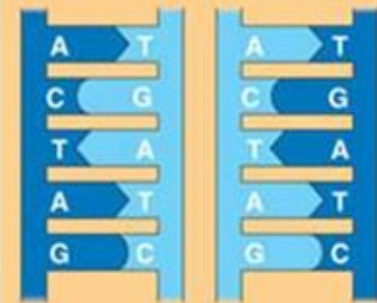
(a) The parent molecule has two complementary strands of DNA. Each base is paired by hydrogen bonding with its specific partner, A with T and G with C.



(b) The first step in replication is separation of the two DNA strands.

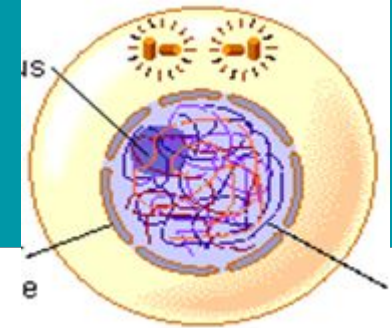


(c) Each parental strand now serves as a template that determines the order of nucleotides along a new, complementary strand.

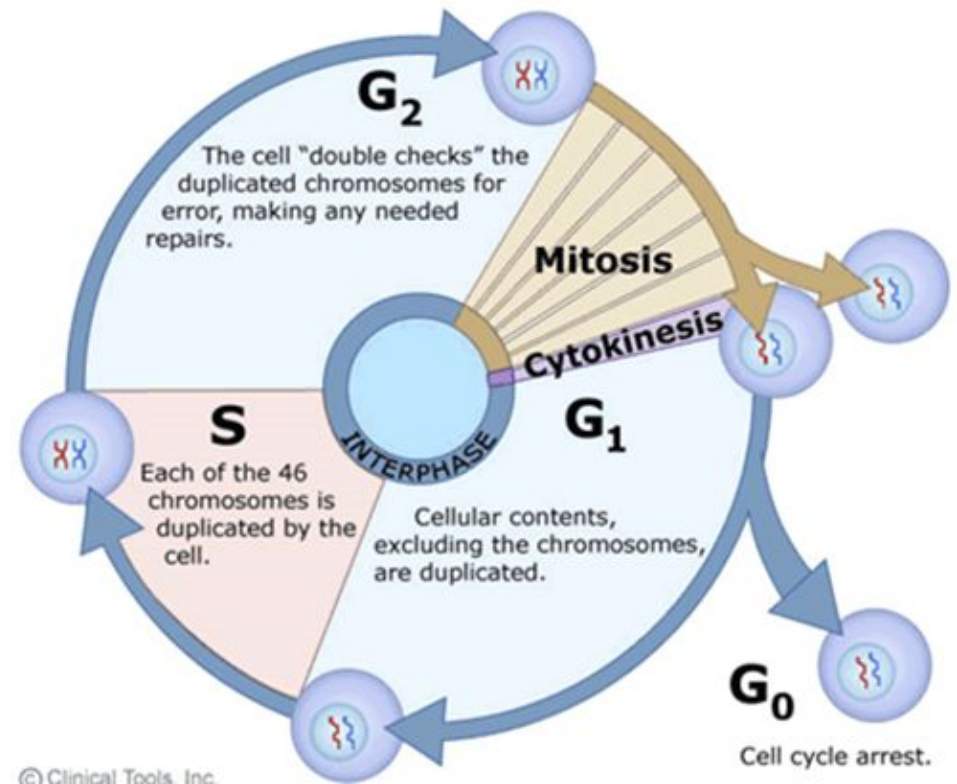


(d) The nucleotides are connected to form the sugar-phosphate backbones of the new strands. Each "daughter" DNA molecule consists of one parental strand and one new strand.

G₂ Phase

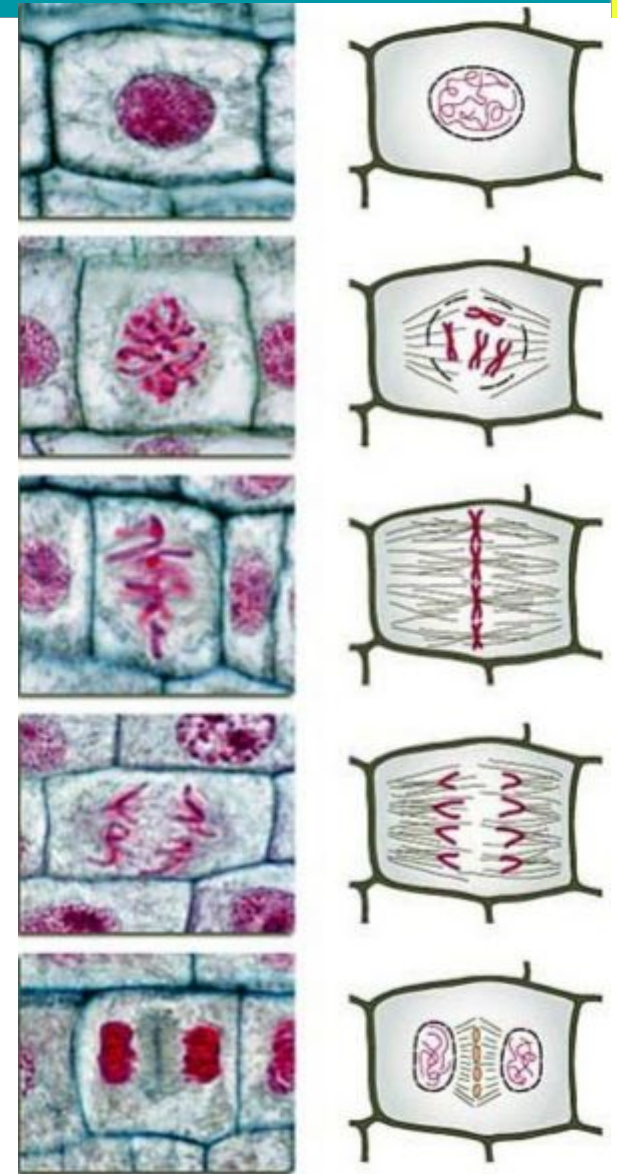
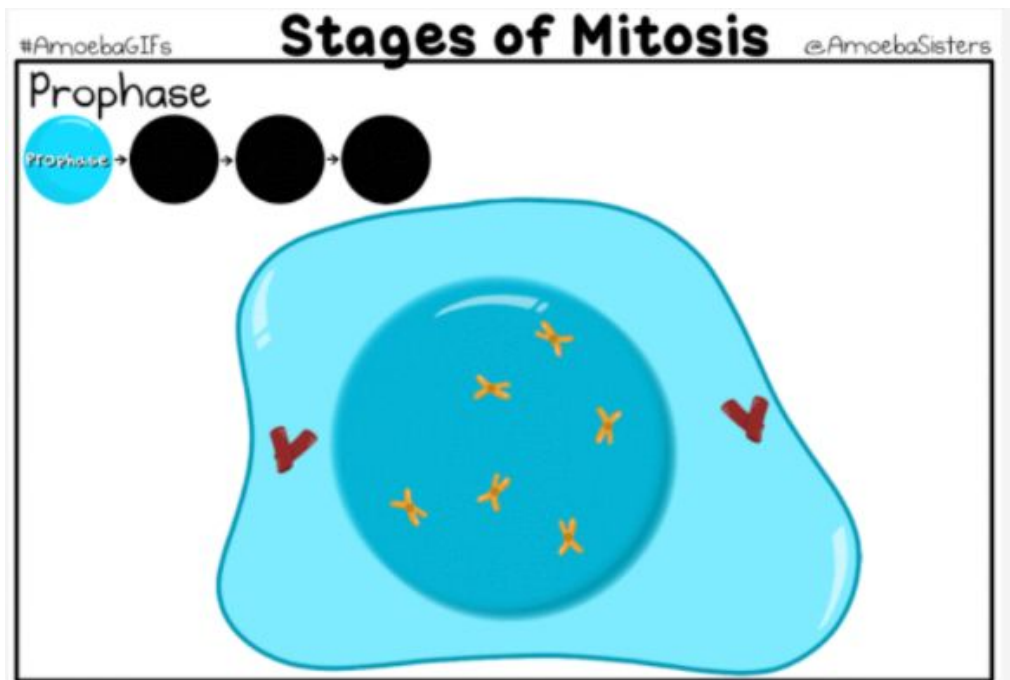


- **G₂ Phase:** many of the organelles and molecules required for cell division are produced. When G₂ is completed, the cell is ready to enter the M phase.

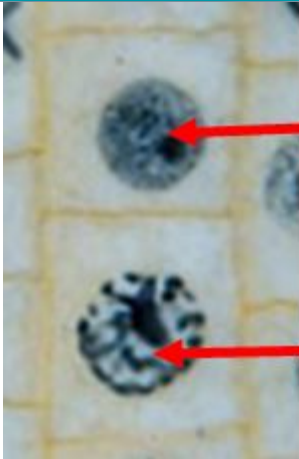


What is Mitosis

- Division of a cell's nucleus
- Four phases: prophase, metaphase, anaphase, & telophase



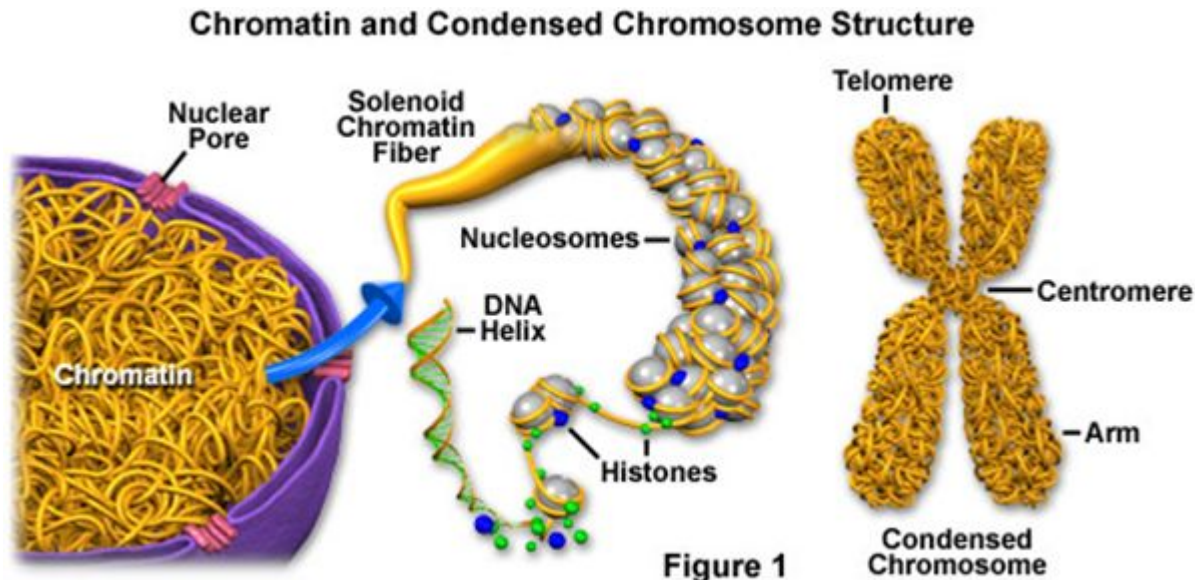
Chromatin vs. Chromosomes



Chromatin is loosely coiled DNA

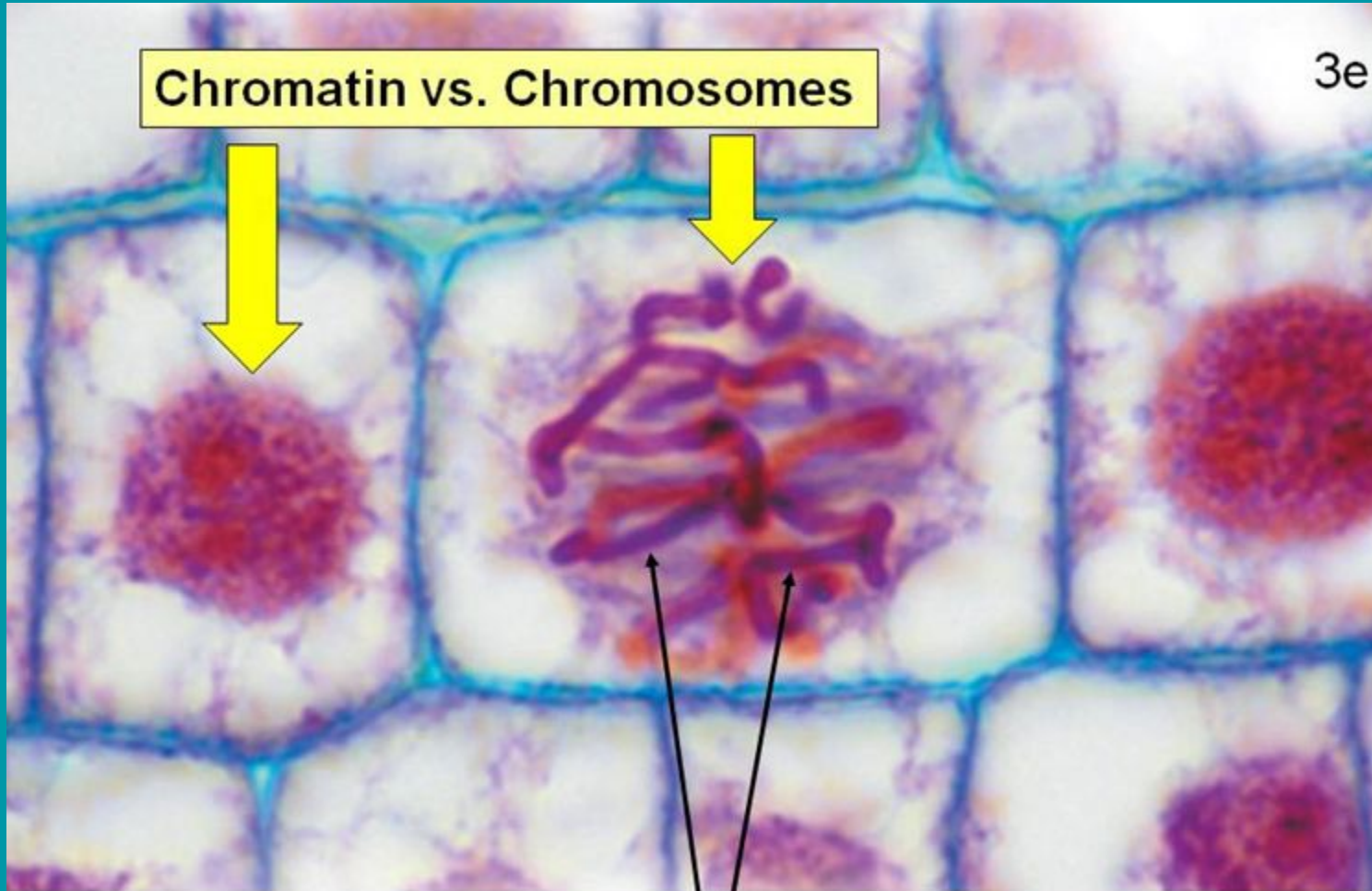
Chromosomes are tightly coiled DNA

-DNA is tightly coiled around proteins called histones

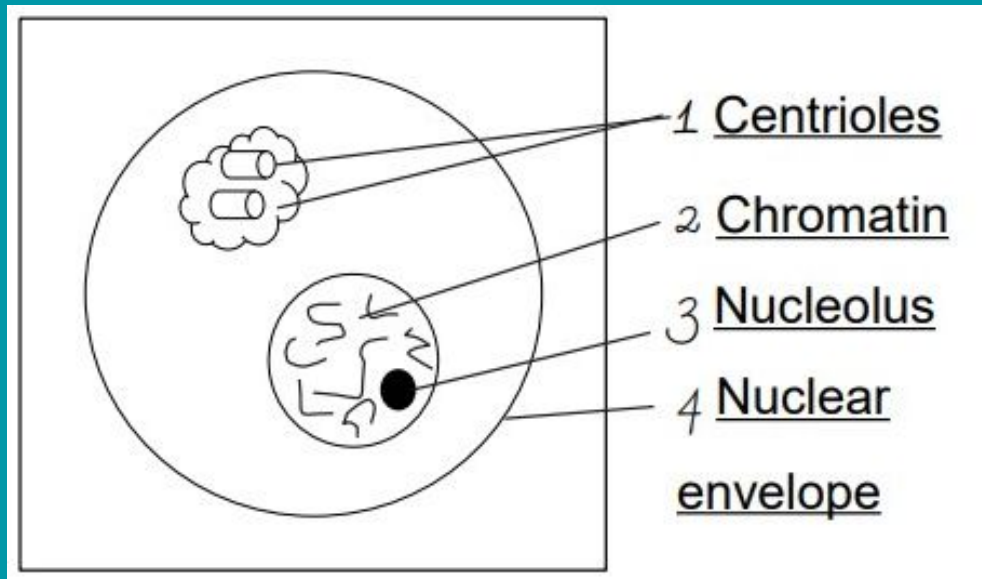


Chromatin vs. Chromosomes

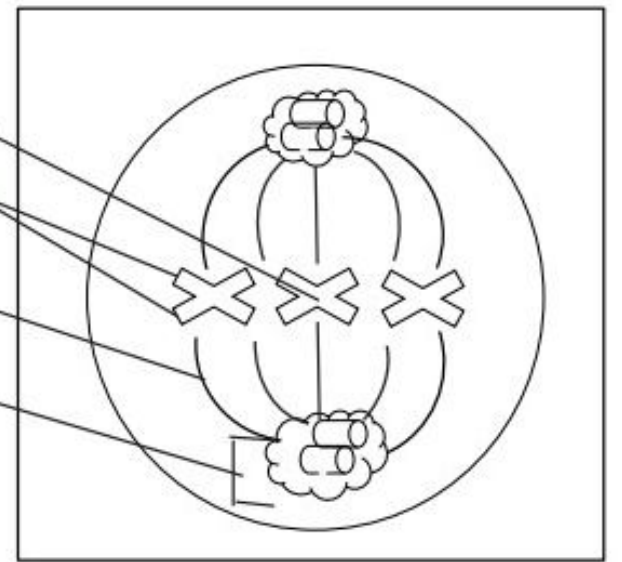
3e



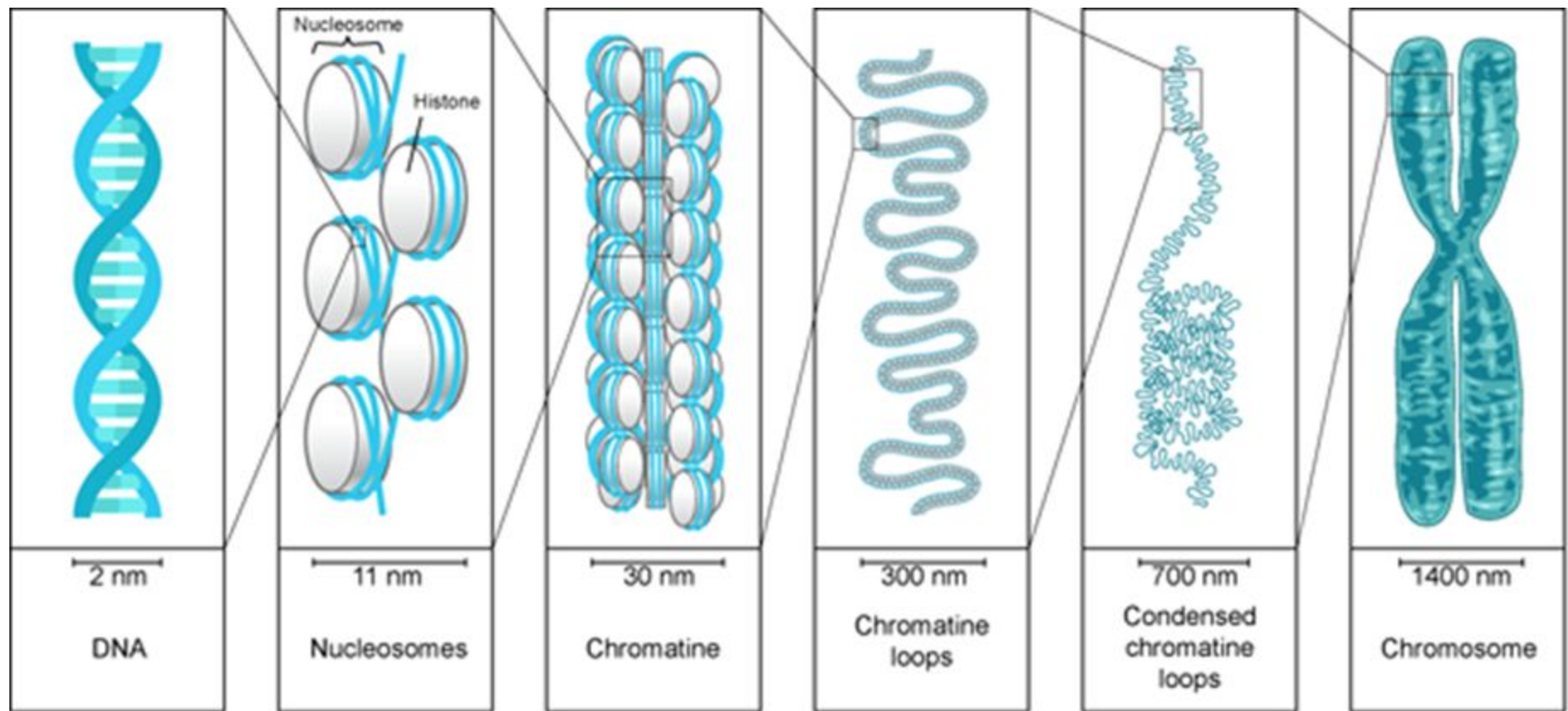
Chromosomes



- 5 Chromosome
- 6 Sister chromatids
- 7 Spindle fiber
- 8 Centrosome



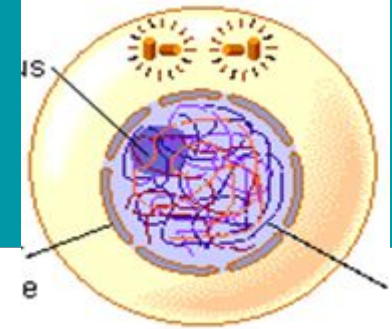
How does chromatin condense into chromosomes?



UNIT 4

Mitosis

Interphase

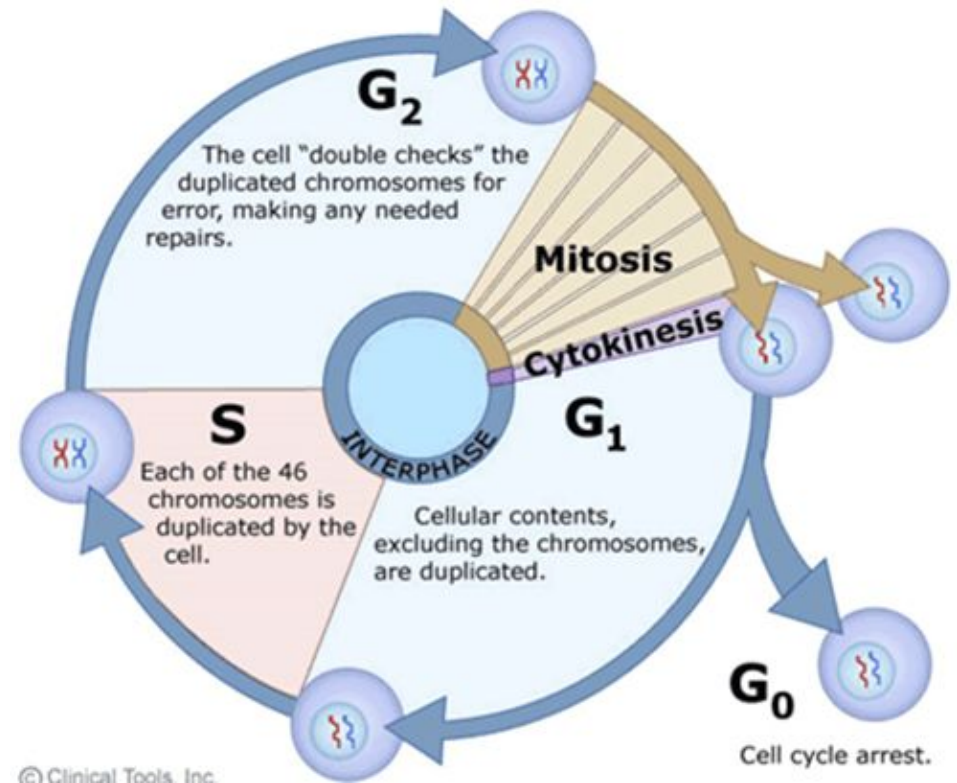


- Longest phase
- The period of growth that occurs between cell division
- Interphase is divided into three phases: G₁, S, G₂

G₁ - growth

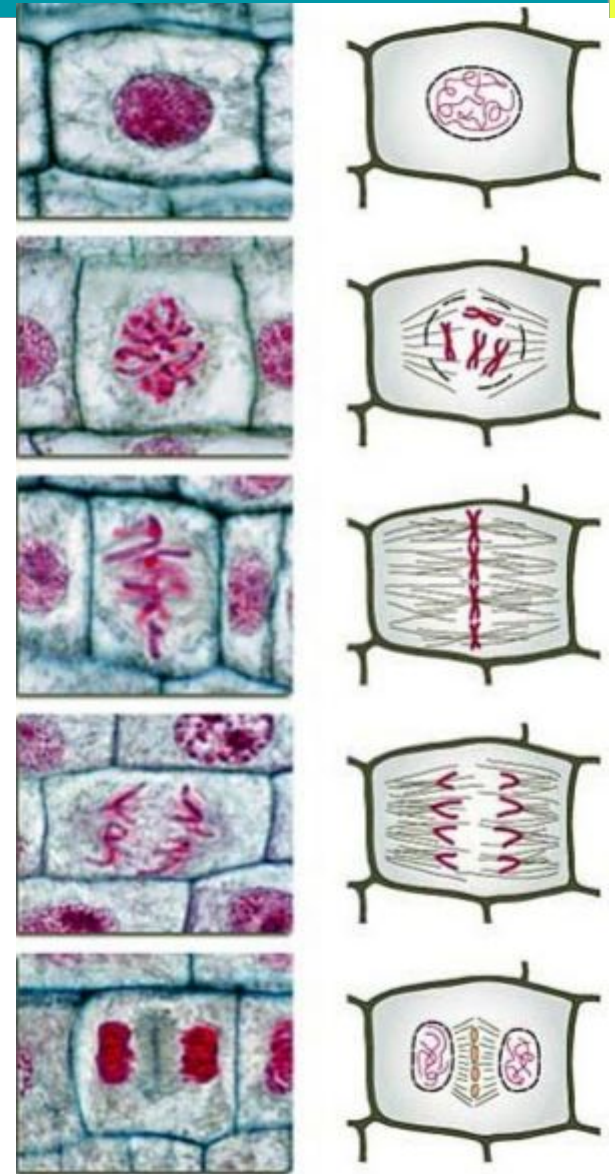
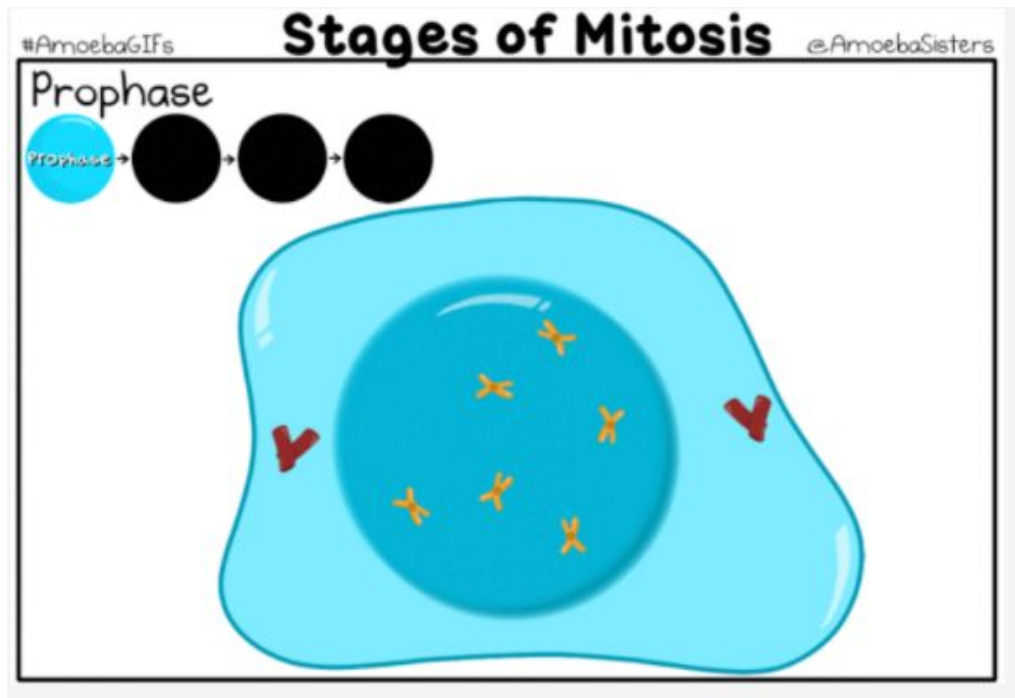
S - synthesis (DNA replication)

G₂ - growth, checklist



What is Mitosis

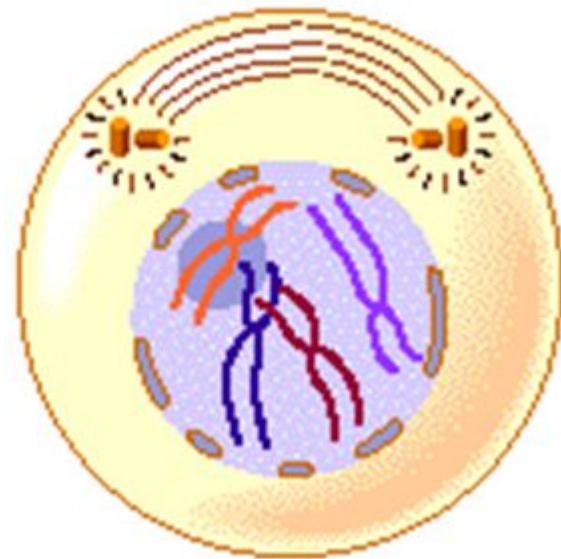
- Division of a cell's nucleus
- Chromosomes (DNA) are equally divided



Mitosis

Step 1: Prophase

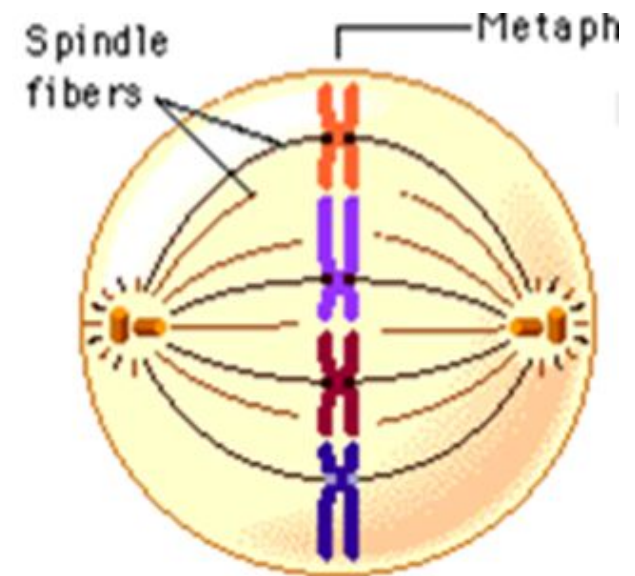
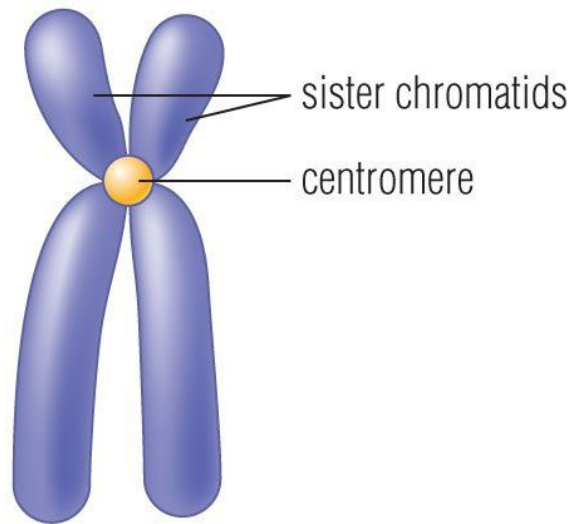
- DNA condenses from chromatin to chromosomes
- Nucleus (nuclear membrane) begins to disappear
- Spindle fibers form



Mitosis

Step 2: Metaphase

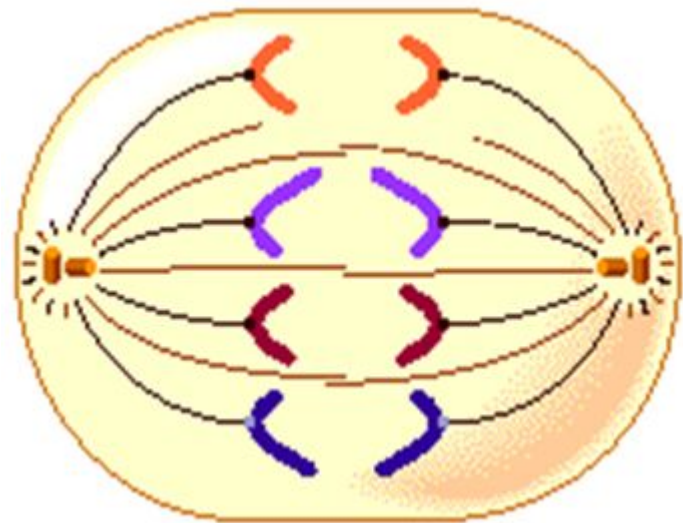
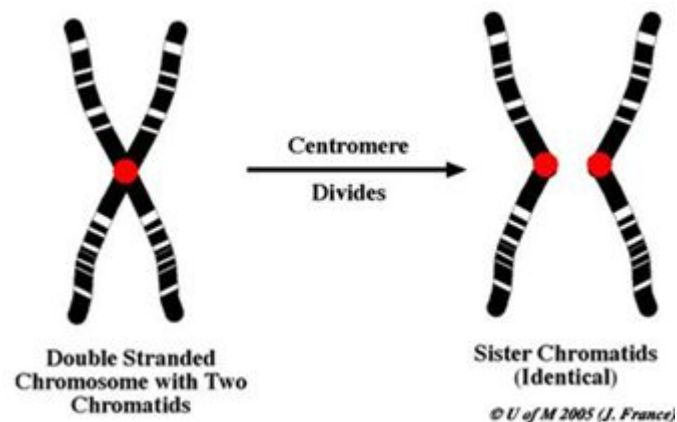
- Chromosomes line up along the equator/middle
- Spindle fibers connect to each chromosome



Mitosis

Step 3: Anaphase

- Sister chromatids are pulled apart



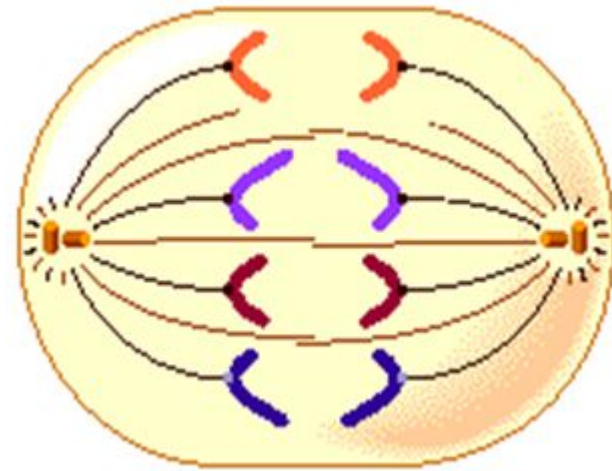
Centrioles and Spindle Fibers

Compare this to a fisherman catching a fish.

fishing pole = centriole

fishing line = spindle fiber

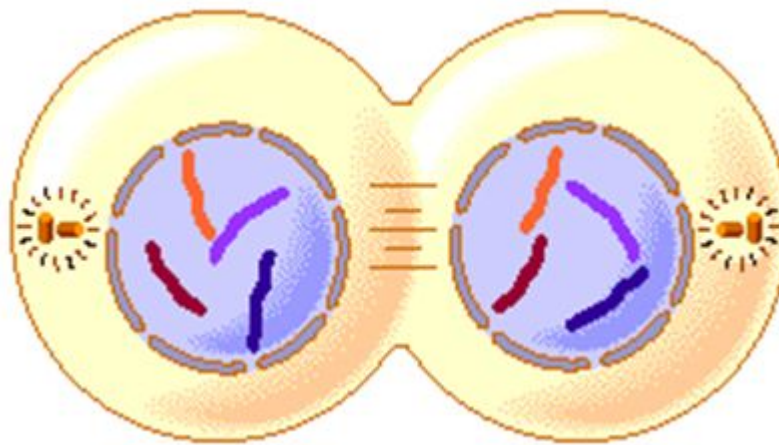
fish = sister chromatids



Mitosis

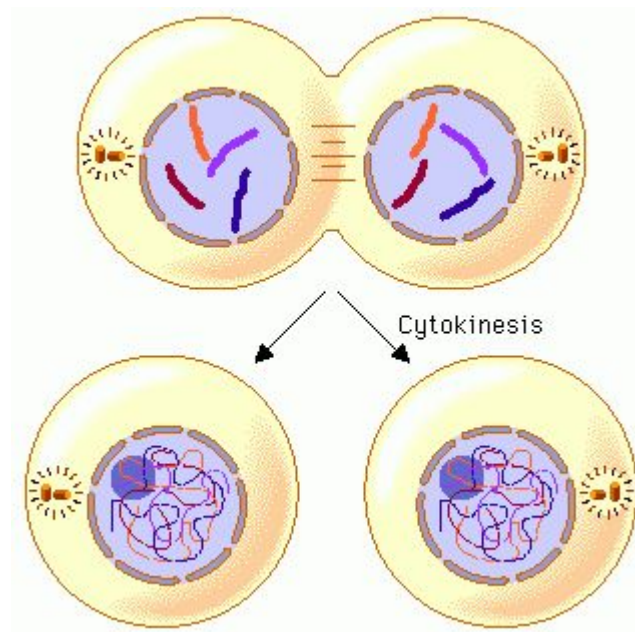
Step 4: Telophase

- New nucleus forms around each set of chromosomes
- Cell membrane begins to pinch in the middle
- Chromosomes unwind back into chromatin



Cytokinesis: Division of the cytoplasm

- Cell membrane pinches in half
- Results in 2 identical daughter cells (each has a complete set of chromosomes)



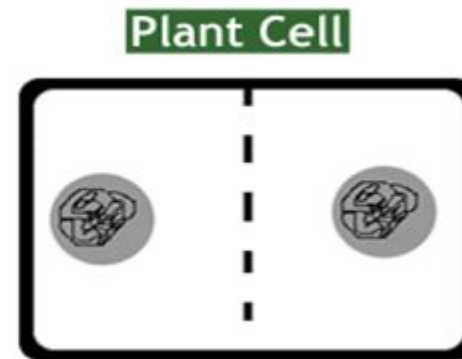
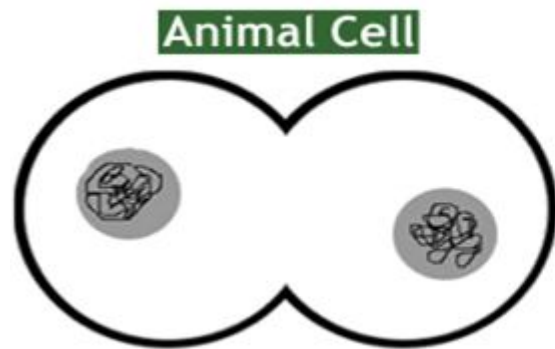
Cytokinesis: Animal vs Plant Cells

■ Animal cell

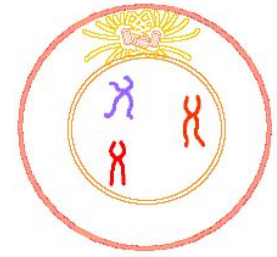
- Cell membrane pinches along equator
- Forms a **cleavage furrow** that deepens until the cell is pinched in two

■ Plant cell

- Cell membrane does not pinch in b/c of rigid cell wall
- **Cell plate** forms at the equator that divides the cytoplasm



I Play Music At The Club



- **I**—Interphase “The DNA is COPIED”
- **P**—Prophase “Cell PREPARES and chromosomes become visible”
- **M**—Metaphase “The chromosomes line up in the MIDDLE”
- **A**—Anaphase “The chromosomes APART”
- **T**—Telophase “The cell begins to pinch into TWO cells”
- **C**—Cytokinesis “The cytoplasm divides”

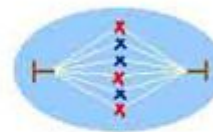
Interphase



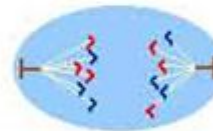
Prophase



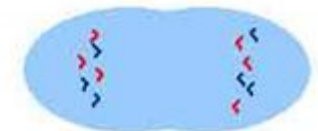
Metaphase



Anaphase



Telophase

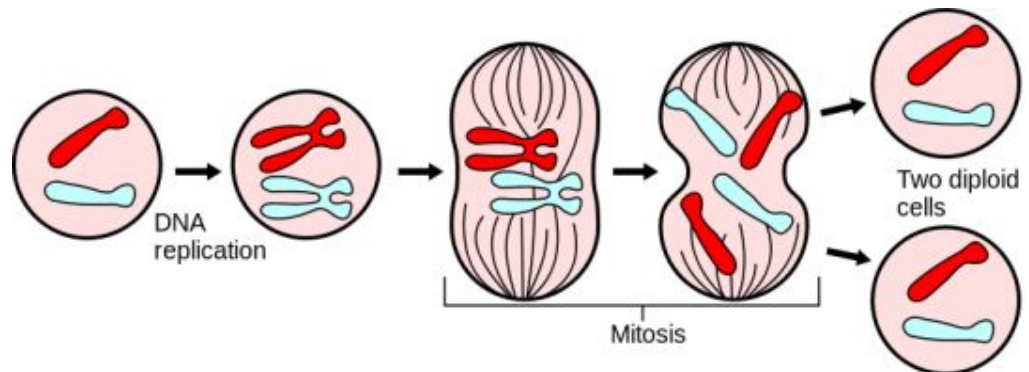


Cytokinesis



Purpose of Mitosis (Cell Division)

- Used for growth and healing
- Mitosis results: 2 new identical daughter cells are also identical to the parent/original cell
- All somatic (body) cells are diploid.
- When a full set of chromosomes are in a cell, it is said to be diploid.
- Full set=
1 from mom & 1 from dad



Practice

- If the parent cell contains 46 chromosomes, how many chromosomes will be in each daughter cell?

Answer: 46 chromosomes

The cell always makes an IDENTICAL copy of itself.

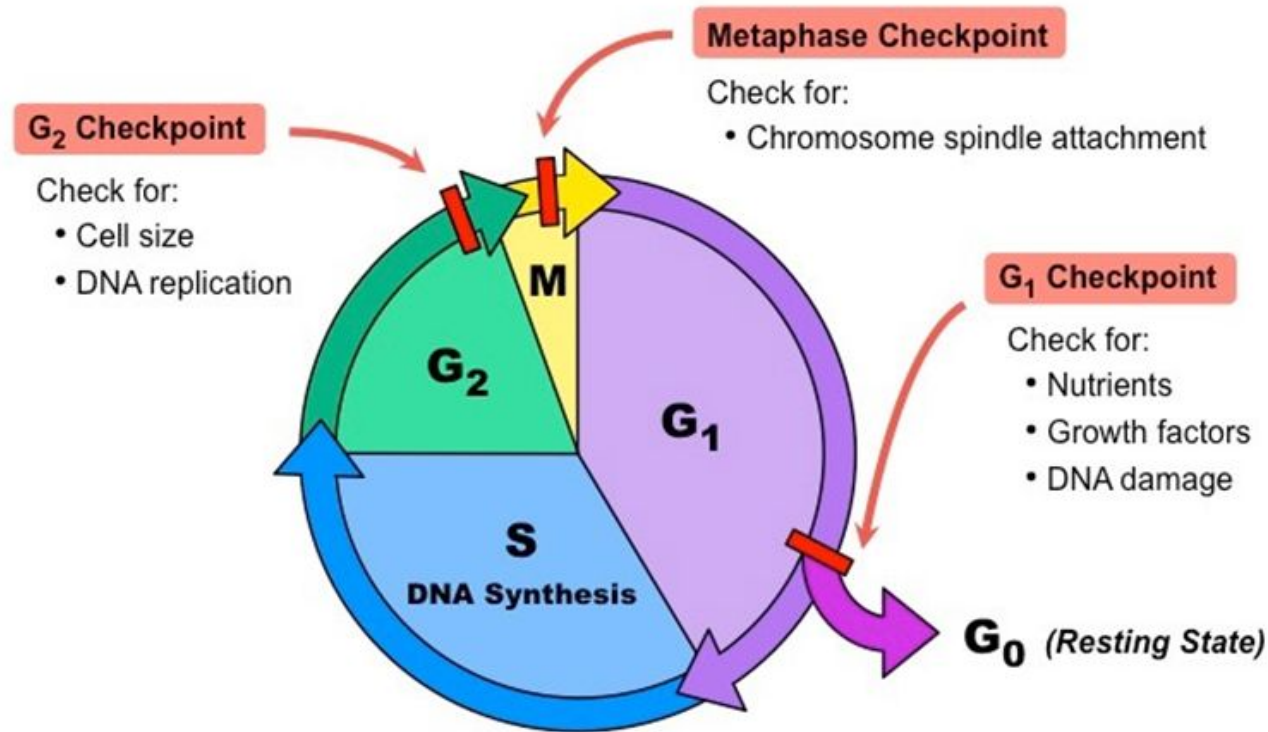


Students, write your response!

Practice

What would happen if the checkpoints do not function?
What if it just continuously went through the cell cycle?

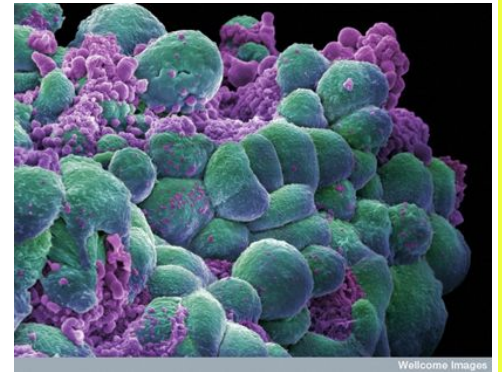
Cancer



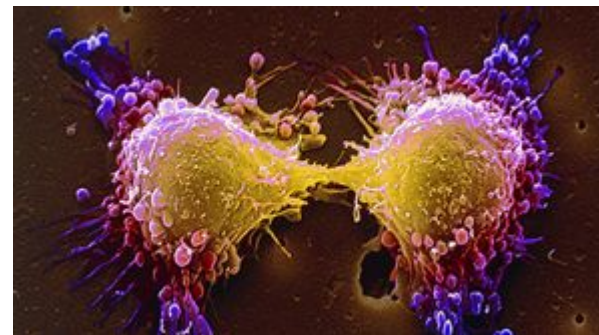
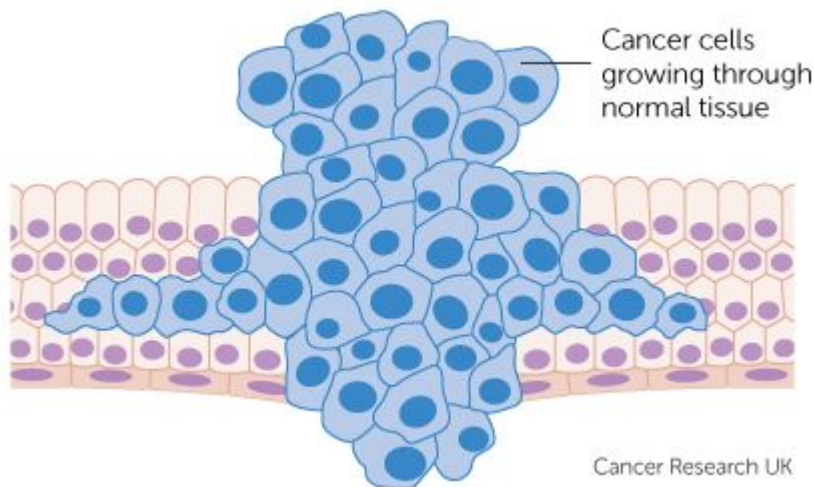
Cancer: How Does It Happen?

Cancer: uncontrolled cell growth.

- Occurs if a mutation causes the cell to not be checked correctly during the Interphase checkpoints.
- Lots of cancer cells piled together create a tumor.



Photograph of
breast cancer cells



Watch this [video on cancer and treatments!](#)