NOTES 3.1

Chapter 3 - From a Cell to an Organism
Lesson 1 - The Cell Cycle and Cell Division

The Cell Cycle

What happen to cells when you hurt yourself? ... they die!

When cells need to reproduce it is important that all new cells have the exact same structures and carry out the same functions.

This is a process known as the **cell cycle**

Q: What is the cell cycle?
A: a cycle of growth, development, and division that most cells in an organism go through

Through the cell cycle, organisms **grow**, **develop**, **replace** old or damaged cells, and **produce** new cells.

Phases of the Cell Cycle

The cell cycle is divided into **2** phases – **interphase** and the **mitotic phase**

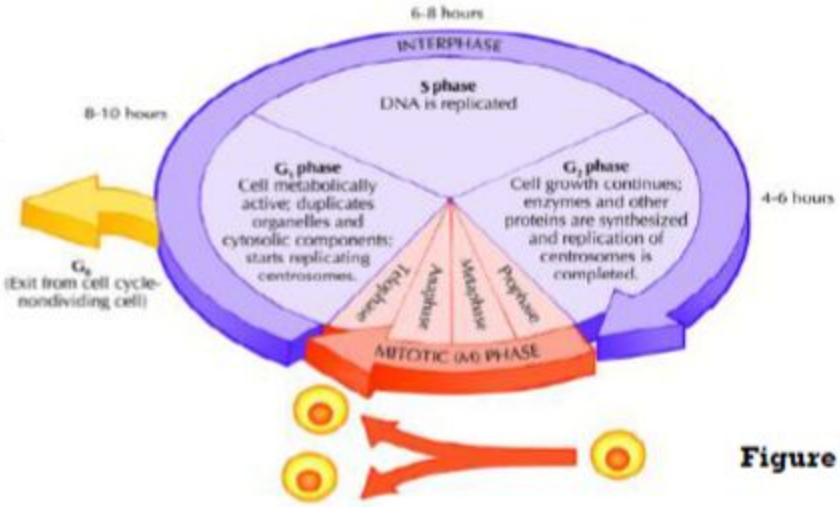
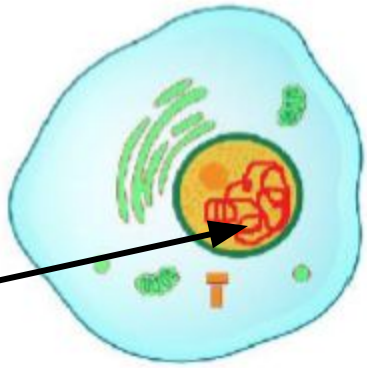


Figure 1

Phase 1 - Interphase - the period before cell division begins where a cell grows and develops

During interphase the cell...

- period of rapid **growth**
- doubles in **size** and **produces** all **organelles** functions needed for **cell**
- contains **DNA** called **chromatin**



Q: What is chromatin?
A: long, thin strands of DNA in the nucleus; looks like a 'plate of spaghetti' when viewed under a microscope

- makes a copy of its DNA in a process called **replication**

Q: What is replication?
A: the process by which a cell makes a copy of the DNA in its nucleus

- prepares to **divide** into **2 cells** by producing **structures** needed to divide during the rest of the cell cycle

Stages of Interphase

Interphase can be divided into 3 different stages- G1, G2, and S (see Figure 1 on slide 1)

G1 stage

- period of rapid growth
- longest stage of the cell cycle
- cell grows and carries outits normal cell functions

* FYI -
→ the cells that line your stomach make enzymes that help you digest your food
→ mature nerve cells in your brain remain in G_1 and do not divide again

S stage

- cell grows and copies its DNA
- strands of chromatin are copied
- chromosomes, chromatids and centromeres form

Q: What is a chromosome?
A: the double rod shaped structures made of condensed chromatin and contains DNA

Q: What is a chromatid?
A: an identical rod of a chromosome

Q: What is a centromere?
A: the structure that holds the 2 chromatid strands together

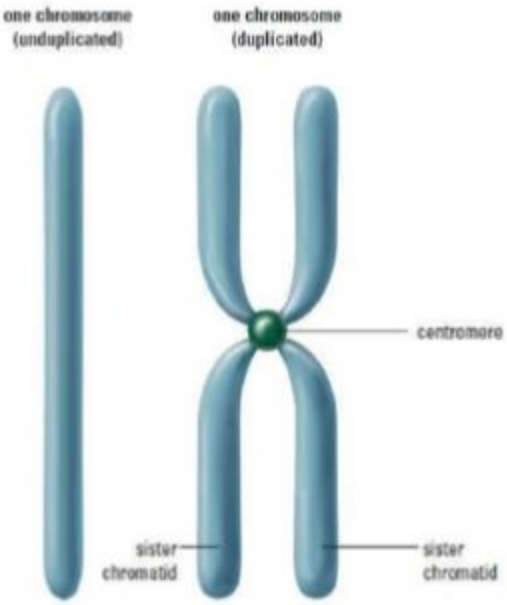


Figure 2

G2 stage

- cell uses energy to copy DNA
- cell stores energy that will be used during mitosis

Phase 2 - The Mitotic Phase

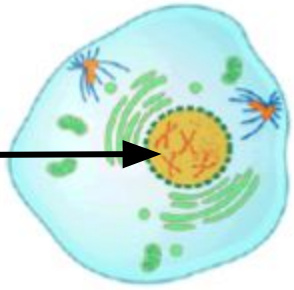
There are 2 stages of the mitotic phase - mitosis and cytokinesis

Mitosis - the cell's nucleus divides into 2 new nuclei and 1 copy of the DNA is distributed into each daughter cell

There are 4 phases of Mitosis - **prophase**, **metaphase**, **anaphase**, **telophase**

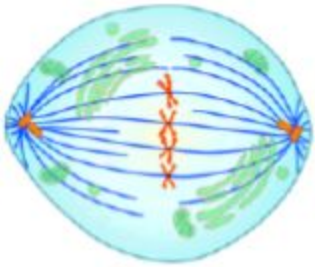
1. prophase

- DNA condenses into chromosomes (see Figure 2 on slide 2)
- spindle fibers form a "bridge" across the cell
- nuclear membrane breaks down



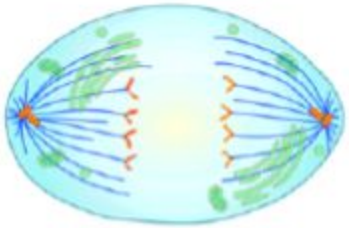
2. Metaphase

- chromosomes line up in the middle of the cell and attach to a spindle fiber at its centromere



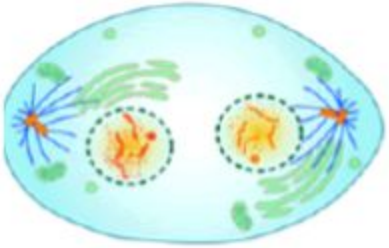
3. Anaphase

- centromeres split and the 2 chromatids separate moving to opposite ends of the cell



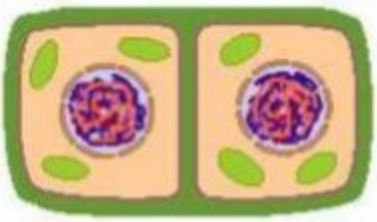
4. Telophase

- chromosomes stretch out
- new nuclear membranes around each chromatin
- 2 identical nuclei form

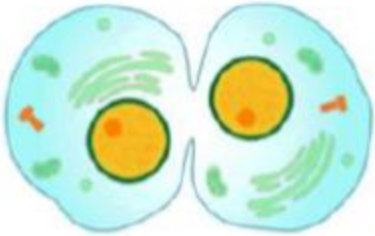


Cytokinesis - the cell's cytoplasm divides and distributes organelles into each of the 2 new cells

In **plant** cells, a Cell plate forms to divide each new cell.



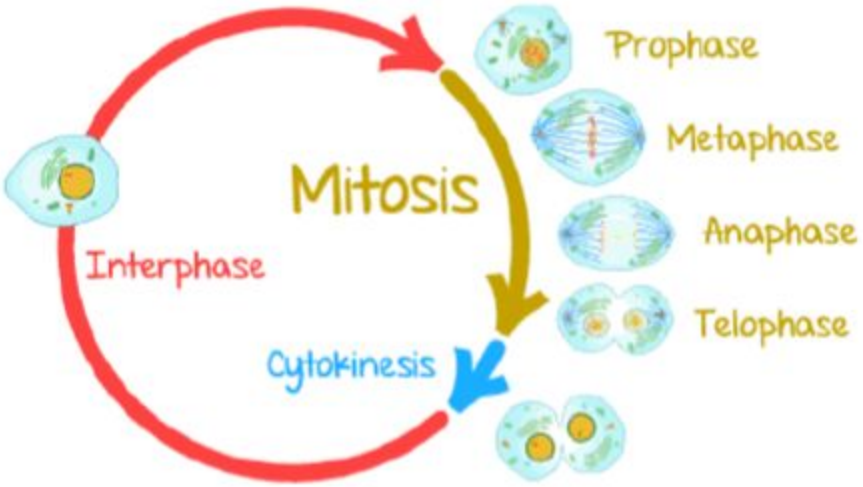
In **animal** cells, a furrow forms to divide each new cell.



Results of Cell Division

The cell cycle results in 2 new cells. These daughter cells are genetically the same. They are the same as the original cell that no longer exists. A human cell has 46 chromosomes. When the cell divides, it produces 2 new cells, each with 46 chromosomes.

The cell cycle is important for reproduction in some organisms, growth in multicellular organisms, replacement of worn-out or damaged cells and repair of damaged tissues.



Length of the Cell Cycle

So, how long does the cell cycle last? It differs from cell to cell. The time it takes a cell to complete the cell cycle depends on the type of cell that is dividing.

Some can take as little as 8 minutes; others may take up to one year. Some cells can take as little as 2 hours to as much as 22 hours!

Most of the cells in the human body can complete the cell cycle in about 24 cells. The cells of some organisms divide very quickly.

For example, the fertilized egg of the zebra fish divides into 256 cells in 2.5 hours!