The Cell Cycle

- the cycle of cellular growth and division

- a continuous production of new cells

- each cycle you get one new cell (1 to 2)

- Eukaryotic cell division (prokaryotes = binary fission)

- 3 Main Stages

  * Interphase
  * Mitosis
  * Cytokinesis

G1, S, G2

1 prophase
2 metaphase
3 anaphase
4 telophase

Interphase

- the cell grows and develops into a mature functioning cell

- the cell duplicates its DNA and prepares for division

- 3 Stages

  G_1 (Gap 1) - cell grows, carries out normal cell function, and prepares for DNA replication

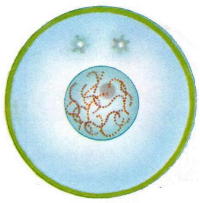
  S (synthesis) - when cell copies its DNA

  - chromosomes → structures that contain genetic information that is passed from generation to generation

  - chromatin → the relaxed form of DNA in cell nucleus

  G_2 (Gap 2) - cell prepares for division of the nucleus, cell takes inventory to make sure it is ready to go into mitosis

** Cell still contains a nucleus and a nucleolus **



Mitosis

- increases the number of cells in a growing individual

- helps to replace damaged cells

- 4 Steps

  * Prophase
  * Metaphase
  * Anaphase
  * Telophase

Prophase

- the stage of mitosis where the cell spends most of its time

- Chromosomes contain genetic material (shaped like an X)

chromatin condenses

sister chromatid - structures that contain identical copies of DNA

½ of the X

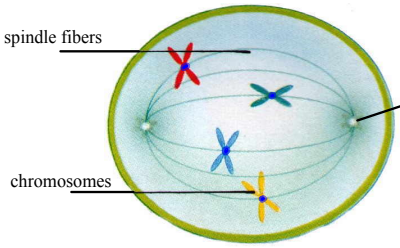
centromere - the center of the chromosome where sister chromatids are attached

- During Prophase

  - the nuclear membrane and nucleolus disappear

  - centrioles begin to migrate to the ends of the cell

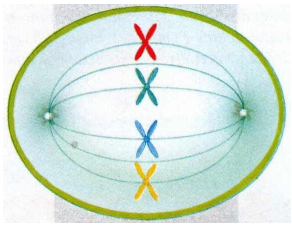
  - near the end of prophase, the spindle fibers attach to the centromeres of the chromosomes



Metaphase

- The sister chromatids are pulled to the center of the cell or the equator by the spindle apparatus

- Shortest stage of mitosis



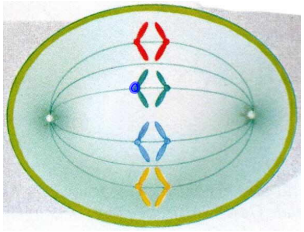
Anaphase

- The chromatids are pulled apart during this step

- microtubules begin to shorten and this pulls at the centromere

- all of the sister chromatids separate simultaneously into two identical chromosomes.

- Each new cell gets an identical chromosome



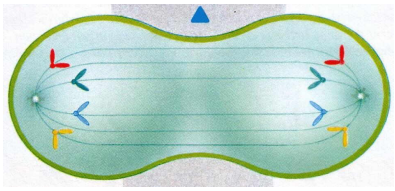
Telophase

- chromosomes arrive at poles of cells and begin to relax and decondense

- 2 new nuclear membranes begin to form and 2 new nucleoli begin to form

- the spindle apparatus breaks down

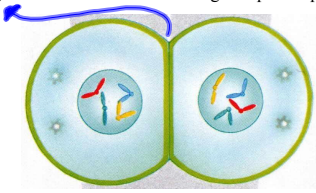
- cell division is not yet complete



Cytokinesis

- the division of the cytoplasm of the new cells

- cleavage furrow - where the cells begin to pinch apart



Cell Cycle Regulation

- cyclins - proteins that help in cycle regulation

- cyclin dependent kinase (CDK)- enzymes that cyclins bind to

- different cyclin / CDK combinations control different activities in the cycl

  * start DNA replication process
  * start nuclear division
  * drive protein synthesis
  * preparation for cell cycle start

fit together like a lock & key

Quality Control Checkpoints

- checkpoints in the cell cycle that can stop it if something goes wrong

G_1 checkpoint - checks for DNA damage

Also checkpoints in S and G_2 phases of the cycle

Apoptosis

- programmed cell death

- not all cells survive

- cells shrivel and shrink

Ex. fingers and feet (webbing)

Stem cells

- embryonic stem cells → are not specialized and can become any kind of cell under the right conditions

  (embryos)

- adult stem cells → found in tissue and used to maintain and repair the same kind of tissue in which they are found