

CELL TRANSPORT

AND THE CELL CYCLE

CELL TRANSPORT



♦ DIFFUSION:

- movement of material from higher concentration to lower concentration
- **OSMOSIS:** Diffusion of water
- **FACILITATED DIFFUSION**
 - Molecules transport across a membrane in the direction of lowest concentration by a carrier protein; no energy required
- **ACTIVE TRANSPORT:**
 - Movement of large material against a concentration difference requiring energy to be used. (Ca, K, Na pumps)



Different States of Diffusion

- ◆ Isotonic solution: concentration of dissolved substances in the solution is the same as the concentration of dissolved substances inside the cell
- ◆ Hypotonic solution: lower outside the cell than inside; more water outside – water moves in
- ◆ Hypertonic solution: higher outside the cell than inside; more water inside – water moves out



CELL TRANSPORT CONT.

PERMEABILITY:

- Ability of a membrane to diffuse material
- depends on concentration differences

PHAGOCYTOSIS:

- surrounding and transporting of large substances

PINOCYTOSIS:

- vacuole formation within a cell; carries liquid in/out of cell

EXOCYTOSIS:

- removal of large molecules from the cell



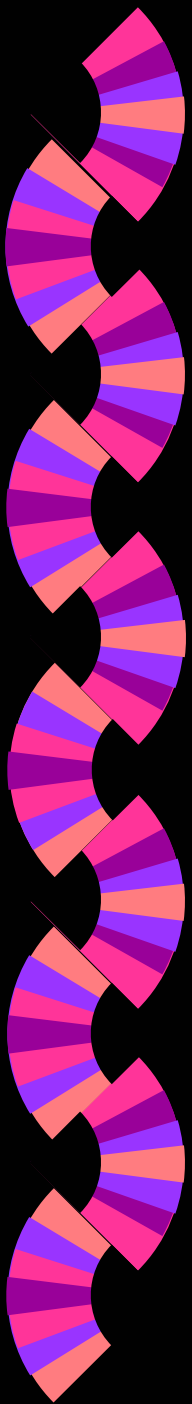
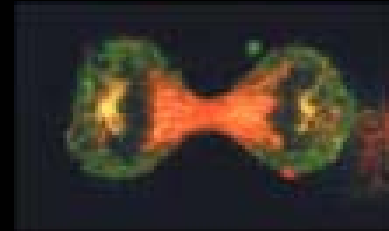
CELL GROWTH

- ◆ Organisms get larger by producing cells
- ◆ As cells increase in size the volume increases faster than the surface area
 - example: diameter of cell increases 10x, surface area increases 100x, volume increases 1000x
- ◆ The larger the cell, the harder it is to get oxygen and nutrients; transcription and protein synthesis becomes difficult
- ◆ cells compensate for cell growth by cell division

CELL DIVISION



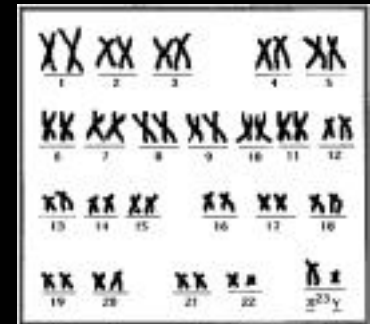
- ◆ Cells divide to form 2 cells
- ◆ Cell division occurs in 2 stages
 - mitosis - nucleus of cell divides into 2 nuclei
 - cytokinesis - cytoplasm divides into 2 cells
- ◆ complicated process due to the fact that there are many chromosomes that need to be passed on



CHROMOSOMES



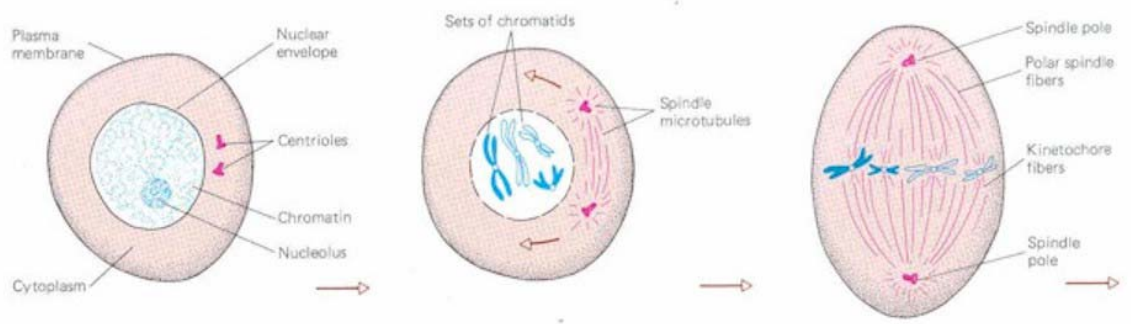
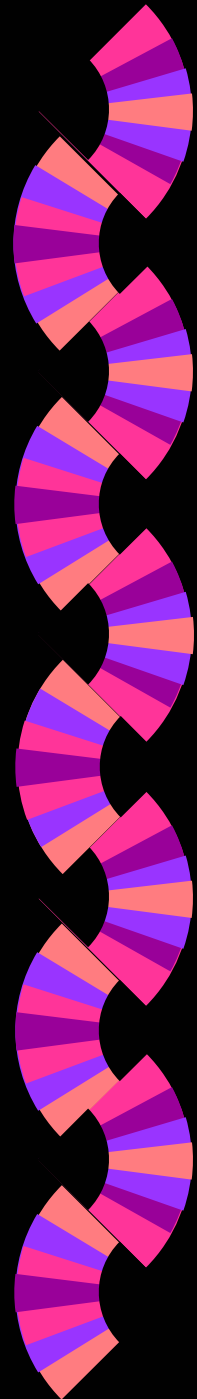
- ◆ They are not visible most of the time
 - only during mitosis
- ◆ They contain the genetic code (DNA)
- ◆ Each organism contains a set amount
 - humans have 46
- ◆ They are made up of chromatin



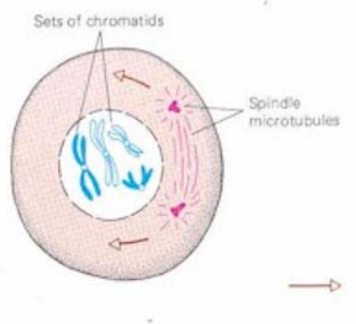


CELL CYCLE

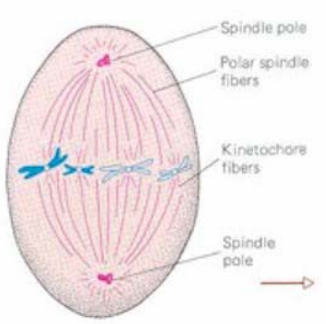
- ◆ Beginning of one mitosis to the beginning of the next
- ◆ cell grows, prepares for division, divides into 2 cells
- ◆ contains different stages
 - mitosis - active division (M phase)
 - interphase - period of non-division (G_1 , S, G_2)



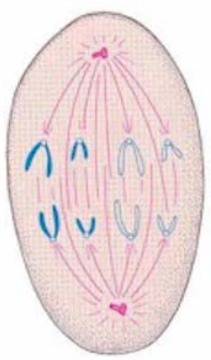
INTERPHASE
Chromatin spread out in indistinct mass. Nucleus and nucleolus distinct.



PROPHASE
Chromosomes condense and become visible as sets of sister chromatids. Nucleolus and nuclear envelope disappear. Spindle microtubules appear.



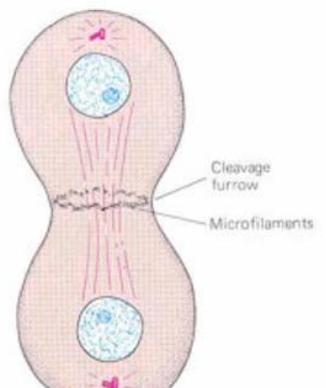
METAPHASE
Mitotic spindle complete. Chromatid sets move to spindle equator



ANAPHASE
Kinetochores divide, freeing sister chromatids as individual chromosomes, which then move to opposite poles of the spindle.



TELOPHASE
Two new nuclei form. Division of the cytoplasm often begins now.



CYTOKINESIS
(as in animal cells)
Microfilaments constrict cell at spindle equator, pinching it in two.



MITOSIS

PROPHASE

- longest phase (50-60% of total time)
- chromosomes appear and attach to spindle
- centrioles separate and migrate to poles
- nucleolus disappears and nuclear envelope breaks down



MITOSIS

- ◆ **METAPHASE:**

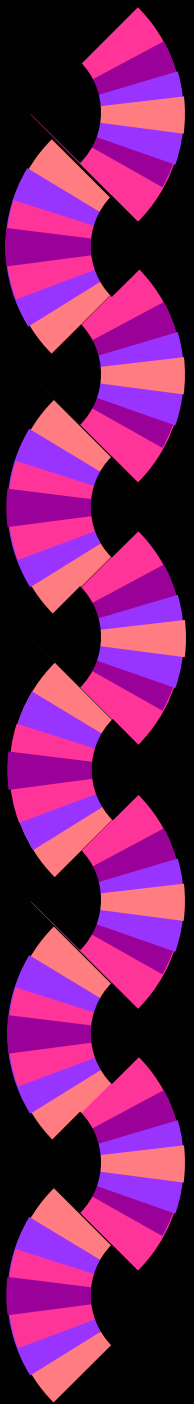
- Shortest phase
- chromosomes line up at equator
- starlike microtubules (asters) appear



MITOSIS

- ◆ ANAPHASE:

- centromeres split
- sister chromatids separate, move to the poles
- spindle grows longer



MITOSIS

- ◆ TELEPHASE:
 - Chromosomes uncoil
 - nuclear envelope reforms around chromatin
 - nucleolus forms



INTERPHASE

- ◆ Usually long time period
- ◆ 3 stages:
 - G1 - gap 1: growth development
 - S - synthesis: DNA synthesis and protein are made
 - G2 - Gap 2: short phase that makes organelles and materials required for cell division
- ◆ nucleus synthesizes mRNA
- ◆ cell makes protein, DNA is copied, ATP is made

Control of the Cell Cycle

- ◆ Enzymes control normal functions
- ◆ Enzyme production is controlled by **genes**
- ◆ When normal control fails, cells can divide at an uncontrolled rate (**Cancer**)
 - Causes of cancer: both genetic and environmental
 - Prevention: healthy diets and exercise, not using tobacco products

