

Chapter 4: Cellular Form and Function

Development of the cell theory:

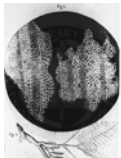
- Hooke in 1663, observed cork (plant): named the cell
- Schwann in 1800's states: all animals are made of cells
- Pasteur's work with bacteria ~ 1860 disproved idea of spontaneous generation (living things from nonliving)
- Modern cell theory emerged by 1900



Modern Cell Theory

- All organisms composed of cells and cell products.
- A cell is the simplest structural and functional unit of life. There are no smaller subdivisions of a cell or organism that, in themselves, are alive.
- An organism's structure and all of its functions are ultimately due to the activities of its cells.
- Cells come only from preexisting cells, not from nonliving matter. All life, therefore, traces its ancestry to the same original cells.
- Because of this common ancestry, the cells of all species have many fundamental similarities in their chemical composition and metabolic mechanisms.

Schwann Theodor, 1810-1882



Le cellule di Hooke,
osservazione su cellule di
sughero

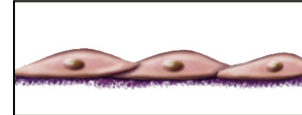


Pasteur Louis, 1822-1895



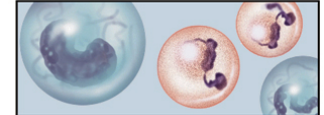
Cell Shapes

Squamous



- thin, flat, angular contours

Spheroid



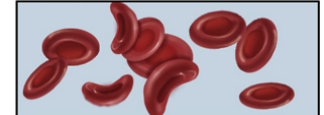
- round to oval

Polygonal



- irregular angular shapes,
> 4 sides

Discoid



- disc shaped

Cell Shapes 2

Cuboidal

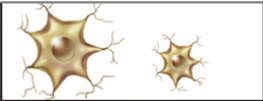


- squarish

Columnar



- taller than wide

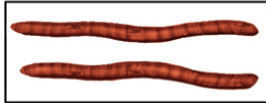


Fusiform (spindle shaped)



- thick middle, tapered ends

Fibrous



- long, slender

Stellate

- nerve cells have extensions, look starlike

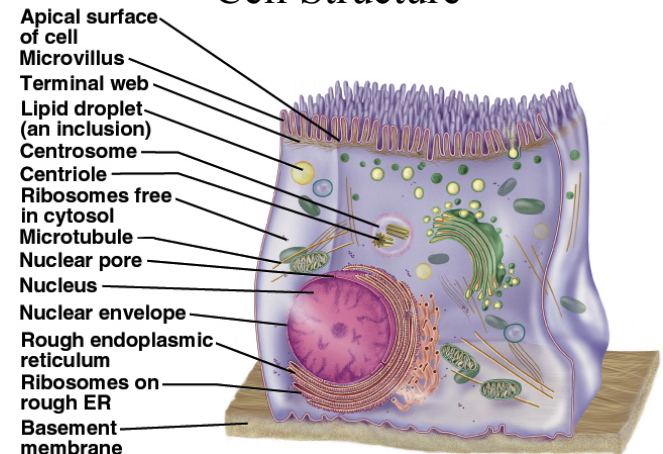
Cell Size

- Human cell size
 - most range from 10 - 15 μm
 - egg cells (very large) 100 μm diameter, visible to naked eye
 - nerve cell over 1 meter, muscle cell up to 30 cm, (too slender to be seen)
- Limitations on cell size
 - as cell enlarges, volume increases faster than surface area so the need for increased nutrients and waste removal exceeds ability of membrane surface to exchange

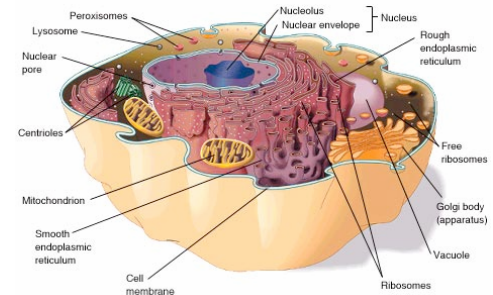
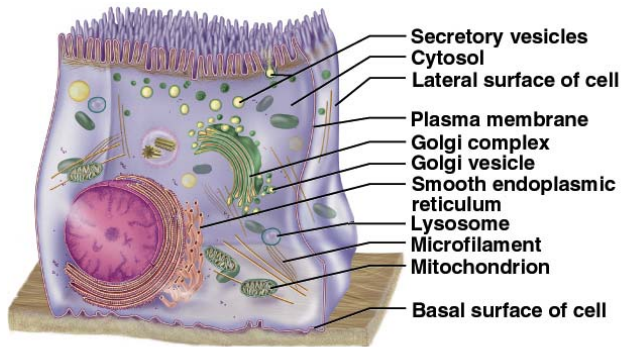
Evolving Perspective on Cells

- Early study with light microscope revealed
 - surface membrane, nucleus and cytoplasm
- Electron microscopes have much higher resolution and revealed much greater details, such as the cell ultrastructure of the cytoplasm
 - fibers, passageways and compartments, and organelles surrounded by cytosol (a clear gelatinous component also called intracellular fluid)

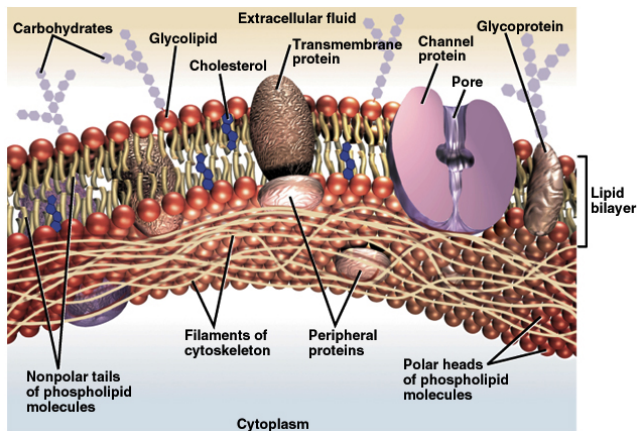
Cell Structure



Cell Structure 2



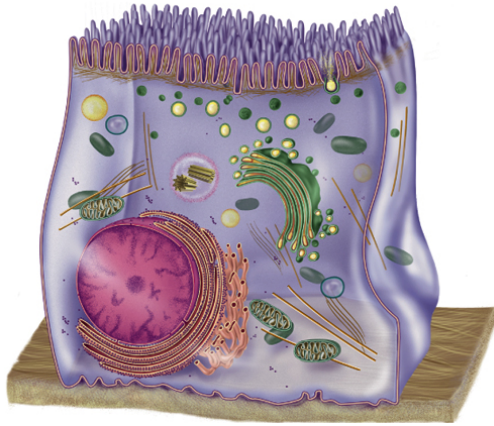
Plasma Membrane Preview



Nucleus

- Largest organelle
- Nuclear envelope surrounds nucleus with two unit membranes
- Contains DNA, the genetic program for a cell's structure and function

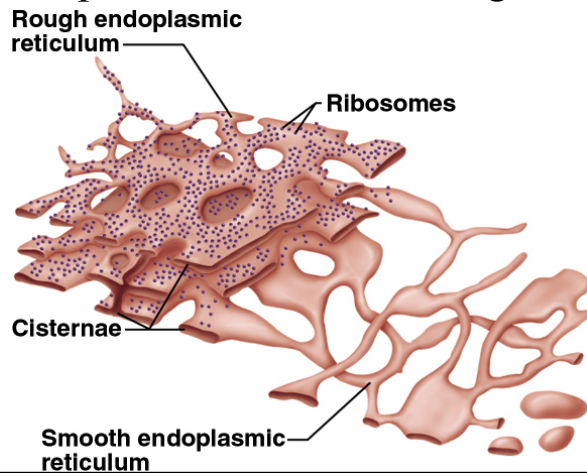
Cell Structure



Endoplasmic Reticulum

- **Rough ER**
 - extensive sheets of parallel unit membranes with cisternae between them and covered with ribosomes, continuous with nuclear envelope
 - function in protein synthesis and production of cell membranes
- **Smooth ER**
 - lack ribosomes, cisternae more tubular and branch more extensively, continuous with rough ER
 - function in lipid synthesis, detoxification, calcium storage

Endoplasmic Reticulum Diagram



Golgi Complex

- Synthesizes CHO's, processes proteins from RER and packages them into golgi vesicles
- Golgi vesicles
 - irregular sacs near golgi complex that bud off cisternae
 - some become lysosomes, some fuse with plasma membrane and some become secretory vesicles
- Secretory vesicles
 - store a cell product for later release

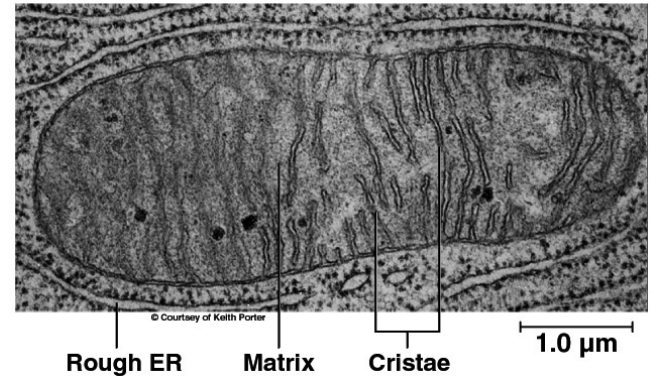


Mitochondrion

- Double unit membrane
- Inner membrane contains folds called cristae
 - ATP synthesized by enzymes on cristae from energy extracted from organic compounds
- Space between cristae called the matrix
 - contains ribosomes and small, circular DNA (mitochondrial DNA)
- Reproduce independently of cell and live for 10 days



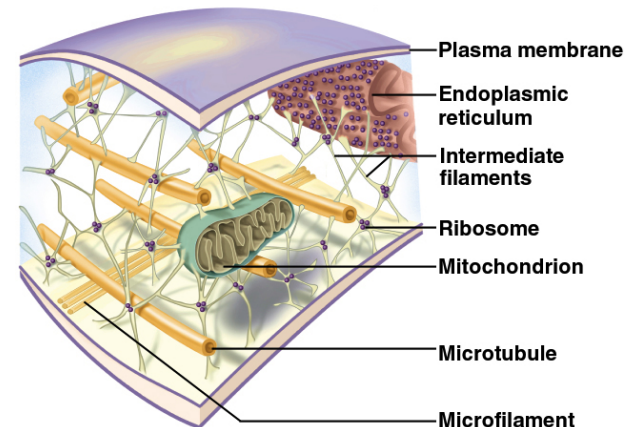
Mitochondrion, Electron Micrograph



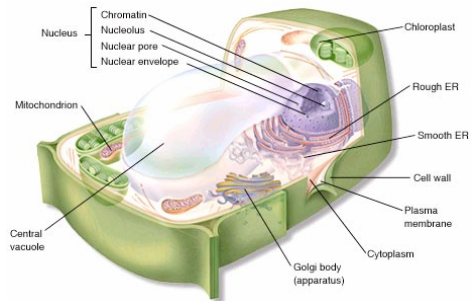
Cytoskeleton

- Microfilaments
 - made of protein actin, form network on cytoplasmic side of plasma membrane called the membrane skeleton
 - supports phospholipids of p.m., supports microvilli and produces cell movement, and with myosin causes muscle contraction
- Intermediate fibers
 - in junctions that hold epithelial cells together and resist stresses on a cell
- Microtubules

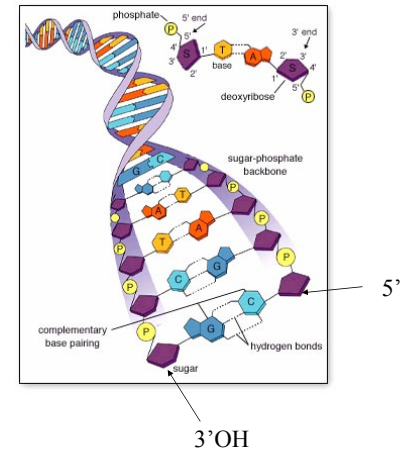
Cytoskeleton Diagram



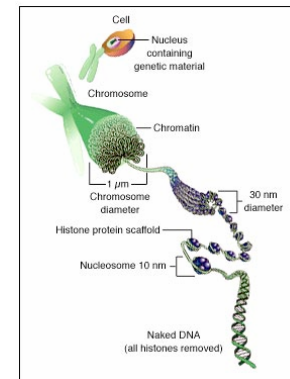
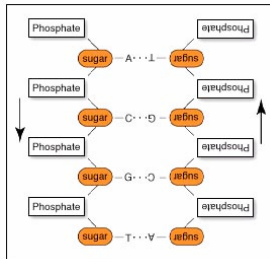
Cellula vegetale



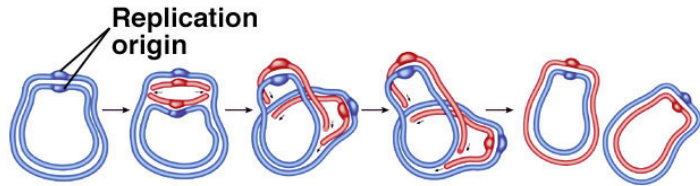
DNA o acido desossiribonucleico



Struttura antiparallela

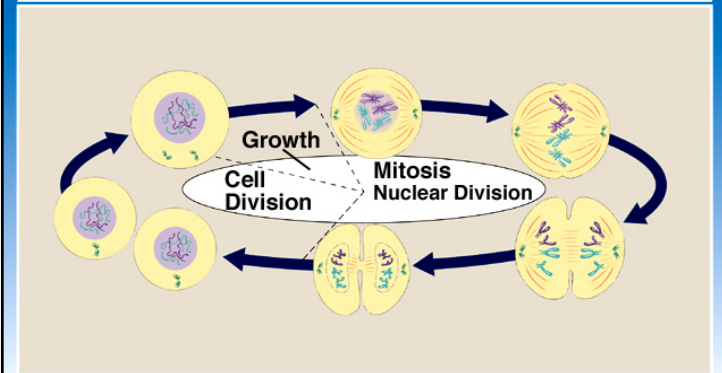


Bacterial DNA Replication

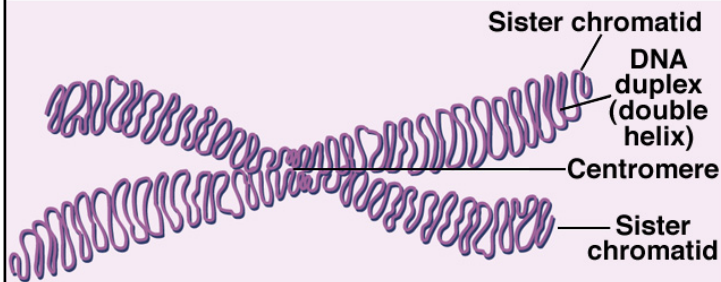


The Cell Cycle

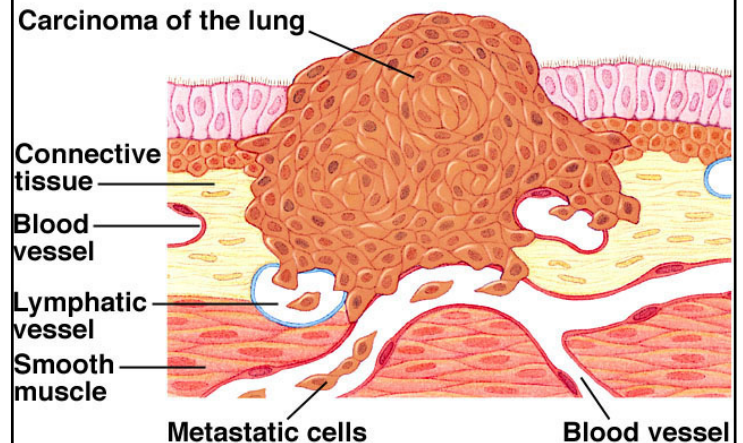
THE CELL CYCLE



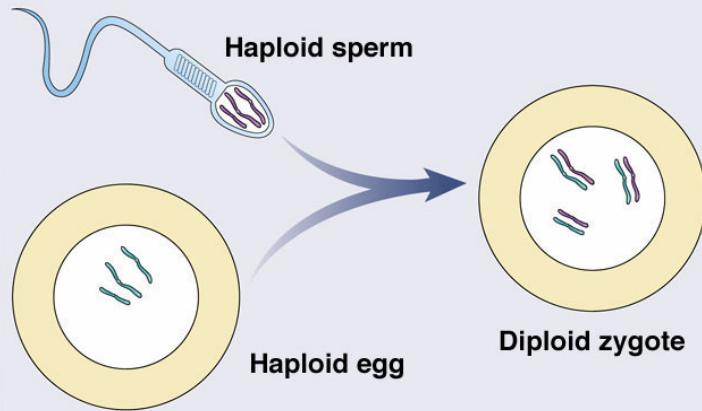
Sister Chromatids



Cancer



Sexual Reproduction



The Sexual Life Cycle

