

I. History of the cell theory

A. Anton van Leeuwenhoek (1600s)

- dutch lens maker could see things with his lenses that were invisible to the naked eye
- developed the simple microscope

B. Robert Hooke (1665)

- developed the first compound microscope
- Proposed the theory that all living things are made up of smaller units = “cells”:

C. Schleiden and Schwann (1830)

- studied plant and animal cells
- developed the idea of the Cell Theory to state that cells are the basis of structure and function of all living things

D. Cell Theory

- Rudolf Virchow (1855)
 - expanded the cell theory to include that all cells came from other living cells
- 1. All organisms are composed of one or more cells
- 2. The cell is the basic unit of organization of organisms
- 3. All cells come from pre-existing cells

E. Types of Microscopes

1. Compound Light Microscope
 - a. uses light
 - b. only magnifies
 - c. uses more than one lens to magnify an object
2. Transmission Electron Microscope (TEM)
 - a. aims a beam of electrons through an object
 - b. shows fine internal detail
3. Scanning Electron Microscope (SEM)
 - a. moves beam of electrons over the surface of the object
 - b. shows surface detail
 - c. gives a 3-D effect

F. Two basic cell types

1. Prokaryotic cells
 - primitive
 - lack internal structures surrounded by membranes
2. Eukaryotic cells
 - have internal membrane bound structures called organelles “small organs”

II. Eukaryotic Cell Structure

A. Boundaries

1. plasma membrane
 - a. serves as a boundary b/w the cell and its environment
 - b. controls movement of materials that enter and leave the cell (i.e. Oxygen, excess water, nutrients, wastes)
 - c. helps control homeostasis
2. cell wall
 - a. relatively inflexible structure
 - b. surrounds plasma membrane in cells of plants, fungi and some bacteria and some protists
 - c. bacteria, protists, and plants have cell walls composed of cellulose
 - d. fungi have cell walls composed of chitin

B. Organelles

1. Nucleus
 - a. manages cell functions in eukaryotic cells
 - b. nuclear envelope
 - four layers thick
 - regulates movement of materials into and out of the nucleus from the rest of the cell
 - c. chromatin
 - long tangled strands of DNA
 - d. DNA (DeoxyriboNucleic Acid)
 - a nucleic acid
 - genetic code of the cell
 - makes master plans for building cell proteins, including enzymes
 - e. nucleolus
 - produces ribosomes which are used in protein synthesis (making proteins)
2. Assembly, transport, and storage
 - a. cytoplasm
 - clear fluid that lies outside the nucleus
 - surrounds organelles
 - b. endoplasmic reticulum (ER)
 - folded membrane

- forms a network of interconnected compartments which provides a large surface area for chemical reactions to occur
- ER connects the plasma membrane to the nuclear membrane and is involved in the assembly of proteins
- smooth ER does not contain ribosomes
- rough ER contains ribosomes

c. Golgi apparatus/complex

- a series of closely stacked, flattened membrane sacs
- receive newly synthesized proteins and lipids from the ER
- package the proteins and ship them out of the cell or to another part of the cell

d. Vacuoles

- sac of fluid surrounded by a membrane
- provide temporary storage of food , enzymes, wastes, water, and other materials
- some vacuoles store waste products
- plant cells have a single large vacuole that stores water and other substances (central vacuole)

e. Lysosomes

- contain digestive enzymes that digest excess or worn-out cell parts, food particles, and invading bacteria or viruses

3. Energy Transformers

a. Mitochondria (pl. mitochondrion)

- contain an outer membrane and a highly folded inner membranes
 - Cristae = the highly folded inner membrane
 - most NRG releasing processes take place here
- energy-storing compounds are produced here

b. cellular respiration is the breakdown of food which releases the chemical energy stored within

c. Plastids

1. chloroplasts (plants)
 - contain chlorophyll
 - trap the sun's NRG and convert it into usable chemical NRG
 - NRG is stored as starches and sugars
2. plastids (general)
 - store starches or lipids
 - contain pigment, are named according to their color or pigment they contain (i.e. chlorophyll = green, fucoxanthin = brown)
4. Structures for support and locomotion
 - a. cytoskeleton
 - thin, hollow tubes and fibers that support organelles
 - microtubules = thin, hollow cylinders made of protein
 - microfilaments = thin, solid protein fibers
 - b. cilia
 - short, numerous, hair like projections from the plasma membrane used for movement
 - c. flagella
 - long projections of the plasma membrane
 - move with a whip like motion
 - cells may have one or two
5. Cellular Organization
 - a. Unicellular
 - made of only one cell
 - i.e. bacteria & protists
 - b. Multicellular
 - composed of many cells
 - i.e. plants & animals
 - c. Tissues - groups of cells functioning together to perform an activity
 - d. Organs - groups of 2 or more tissues that function together
 - e. Organ System - group of organs that work together to carry out major life functions

f. Organism - all of the organ systems functioning together