

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