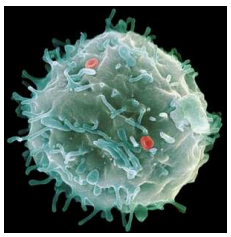
Structures and Functions of Eukaryotic Cells



SBI 4UI

Brainstorm

- What are 7 characteristics of all living things?
- What is the cell theory?

Characteristics of Living Things

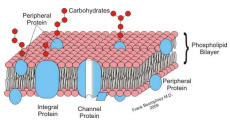
1. Living things require food for energy.
2. Living things respire or take in oxygen gas to break down food for energy.
3. Living things respond to the environment.
4. Living things produce waste.
5. Living things are able to repair themselves.
6. Living things grow and reproduce.
7. Living things have a limited lifespan.

The Cell Theory

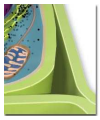
The cell theory consists of three parts:

1. All living things are made up of one or more cells.
2. Cells are the structural and functional units of life.
3. All cells come from pre-existing cells.

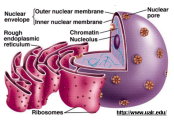
Cell Membrane

Structure	Function
 • phospholipid bilayer with embedded proteins	• separates cell contents from surroundings • controls what enters and exits the cell (selectively permeable)

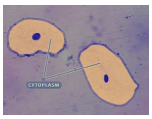
Cell Wall

Structure	Function
 • present in plant cells only • made of cellulose (polysaccharide) and proteins • strong and thick	• provides protection and structural support

Nucleus

Structure	Function
 • **chromatin** – mix of DNA and protein • **nucleoplasm** fills nucleus • **nucleolus** – denser region containing RNA, protein, chromatin • **nuclear envelope** – double membrane separates from rest of the cell	• control centre for entire cell • stores and replicates genetic information (DNA)

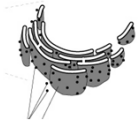
Cytoplasm

Structure	Function
 • jelly-like material • fluid is called **cytosol**	• consists of everything outside of nucleus but within the cell membrane (includes organelles, cytosol, molecules and ions dissolved in cytosol)

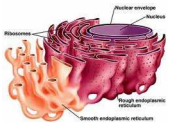
Vacuoles & Vesicles

Structure	Function
 • membrane bound sacs • vesicles form by pinching off of cell membrane • animal cells have many small vesicles, plant cells contain single central vacuole	• vesicle – transport and storage of substances in the cell • vacuole – stores water, ions, sugars, amino acids and macromolecules • quantity of water in vacuole determines internal pressure, keeping plant cells rigid

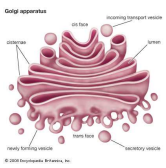
Ribosomes

Structure	Function
 • composed of RNA and proteins • may be attached to ER, or by themselves in cytoplasm	• responsible for synthesis of polypeptides in cytosol

Endoplasmic Reticulum

Structure	Function
 • complex of membrane-bound tubules and sacs • rough ER – bound with ribosomes • smooth ER – no bound ribosomes	• rough ER – site of protein synthesis for proteins that are part of membrane or to be exported from cell • smooth ER – synthesizes lipids and lipid containing molecules (such as phospholipids)

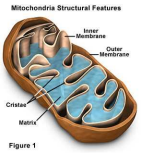
Golgi Apparatus

Structure	Function
 • stack of curved membrane sacs	• packages, processes, sorts and distributes lipids, proteins and other substances within the cell • acts as 'post office' for cell

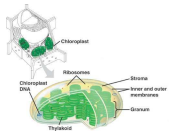
Lysosome

Structure	Function
 • membrane bound vesicle containing enzymes	• catalyze hydrolysis reactions, breaking down macromolecules to be used by the cell • break down old parts of the cell that are no longer needed • break down bacteria and other foreign particles that have been ingested

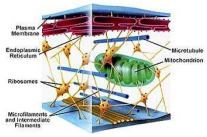
Mitochondria

Structure	Function
 • smooth outer membrane • folded inner membrane called **cristae** • fluid filled space in the inner membrane called **matrix**	• break down high-energy organic molecules to convert stored energy to usable energy for the cell (ATP)

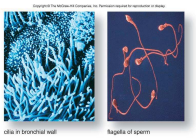
Chloroplast

Structure	Function
 • thick liquid called **stroma** in the inner membrane surrounds a system of flattened disks called **thylakoids**, which contain **chlorophyll** • stack of thylakoids is called **granum**	• site of photosynthesis • chlorophyll absorbs light energy and converts CO_2 and H_20 into energy rich organic molecules through a series of redox reactions

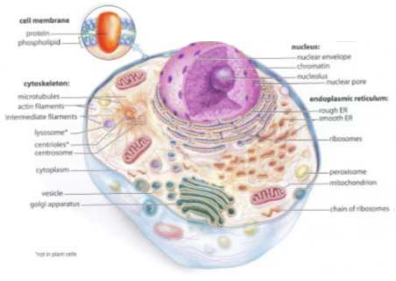
Cytoskeleton

Structure	Function
 • network of protein fibres that extend throughout cytosol	• provides structure, shape, support and mobility

Cilia & Flagella

Structure	Function
 • composed of microtubules (proteins in hollow tubes) • flagella – one appendage • cilia – many shorter appendages	• flagella – like tails, whip-like movement propels cells • cilia – wave-like motion enables organisms to move

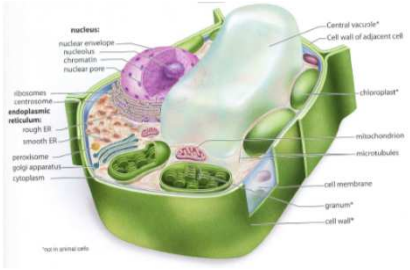
Typical Animal Cell



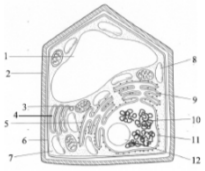
Animal Cell Diagram

1. cell membrane
2. nucleolus
3. chromatin
4. nucleus
5. ribosome
6. mitochondria
7. lysosome
8. cytoplasm
9. rough endoplasmic reticulum
10. golgi apparatus
11. vesicle
12. centriole

Typical Plant Cell



Plant Cell Diagram



1. vacuole
2. cell wall
3. mitochondria
4. golgi apparatus
5. ribosome
6. cell membrane
7. cytoplasm
8. vesicle
9. rough endoplasmic reticulum
10. chromatin
11. nucleus
12. nucleolus

The Cell Membrane

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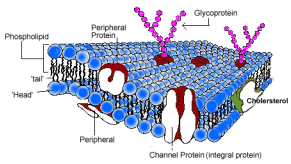

The Cell Membrane

- physically separates the contents of cells from the aqueous environment
- remarkably thin, selective and dynamic cellular boundary
  - if it does not function → cells die

The Cell Membrane

1. Name and describe the current accepted model of the cell membrane.
2. Why is fluidity of the membrane an important property?
3. Describe four factors that affect membrane fluidity.
4. Differentiate between integral and peripheral proteins.
5. Describe four functions of membrane proteins.

Fluid Mosaic Model

- accepted model of the cell membrane
- basic framework of a semi-fluid phospholipid bilayer into which proteins are inserted
  - proteins may be bound on the surface to other proteins, lipids or carbohydrates

Fluidity of the Bilayer

- fluidity of a bilayer is an important property:
  - at room temp → viscosity similar to vegetable oil
  - too fluid → permits too many molecules to diffuse into and out of cell
  - not fluid enough → prevents many molecules from crossing

Factors Affecting Fluidity

- temperature
  - ↑ temp → too fluid, ↓ temp → solidifies
- presence of double bonds in fatty acids
  - ↑ # C=C bonds → kinks in chain, become less tightly packed, more fluid
- fatty acid tail length
  - longer FA tails → more intermolecular attractions → held together more tightly
- presence of cholesterol
  - increases intermolecular forces and holds membrane more tightly together

Proteins in Phospholipid Bilayer

- **integral proteins**
  - embedded in the membrane
- **peripheral proteins**
  - more loosely and temporarily attached to out regions or to integral proteins

Functions of Proteins in Bilayer

- membrane proteins help to stabilize the membrane, as well as perform the following functions:
  - **transport** – substances across membrane
  - **cell recognition** – carbohydrate chains that protrude from proteins enable cells to 'recognize' each other
  - **signal reception** – receptor proteins bind to signal molecules (ie. hormones) which can initiate a cellular response