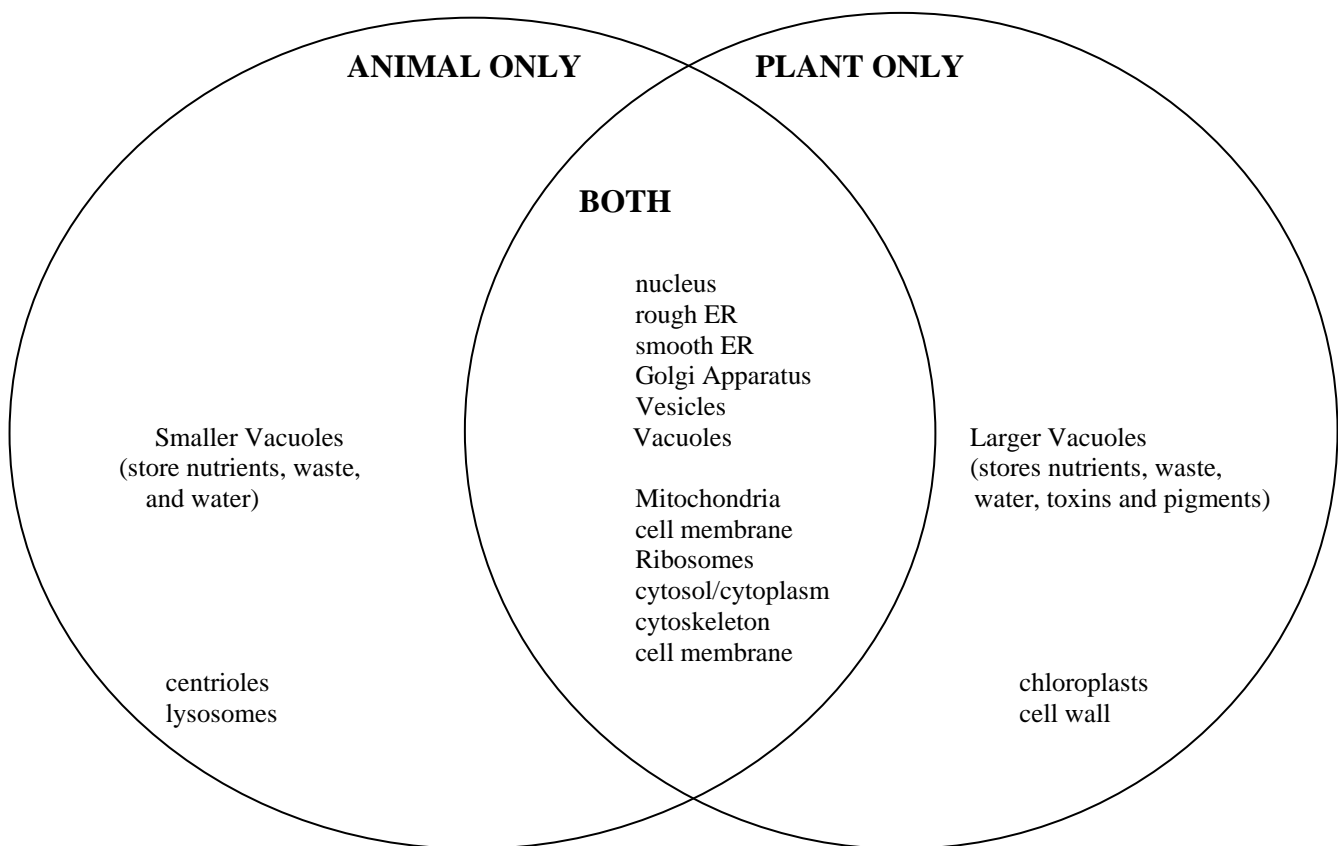


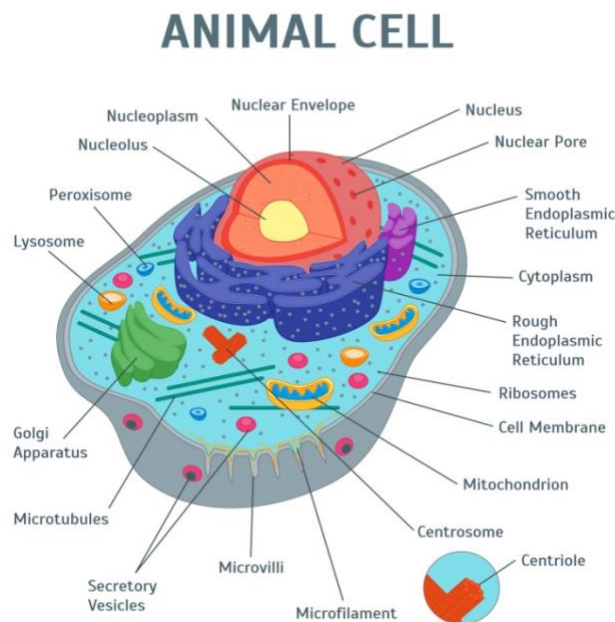
UNIT 2 ANSWER KEY

1. What invention was necessary to enable humans to initially study cells? microscope
2. What are the two key principles of the cell theory?
the cell is the "building block" of all organisms (the basic unit of life, all life forms consist of one or more cells)
all cells come from pre-existing cells (on today's Earth, must of originated/evolved from elsewhere originally)
3. Prokaryotic cells differ from Eukaryotic cells:
 - a. What is the major structural difference?
prokaryote cells lack a true nucleus and other membrane-bound organelles that are found in eukaryotic cells
 - b. This structural difference leads to a functional difference, what is the major functional difference?
prokaryotic cells are generally considered less efficient as their cellular reactions occur throughout the cytosol as opposed to eukaryotic cells which are generally considered more efficient as their reactions occur within particular membrane-bound organelles where the necessary reactants and enzymes can be co-localized and concentrated to better promote the reactions
4. Please compare and contrast the structures/organelles of animal and plant cells in the Venn diagram provided below.



CELL STRUCTURE AND FUNCTION

1. Please state the main functions of each of the following organelles:
 - a. nucleus = Controls gene expression and mediates the replication of DNA during the cell cycle.. Control center of the cell.
 - b. cell membrane = controls what enters and exits cell, defines boundaries of cell from external environment
 - c. mitochondria = converts glucose to ATP which can be used as an energy source to directly drive energy-dependent cellular reactions
 - d. endoplasmic reticulum = rough ER is studded with ribosomes and makes, processes and transports proteins destined for particular organelles, the cell membrane and/or secretion, smooth ER produces lipids such as phospholipids for the cell membrane and steroids for cell signaling as well as detoxifying substances such as drugs and alcohol
 - e. ribosomes = "protein factories", have a key role in translation where they catalyze the formation of peptide bonds between amino acids
 - f. Golgi bodies = further process, sort and package proteins destined for particular organelles, the cell membrane and/or secretion
 - g. Cytoskeleton = internal structure of the cell membrane made of protein fibres. It helps anchor organelles and allows some organelles, like vesicles, to move around the cell.
 - h. Cilia & Flagella = allows for movement of material past the cell or movement of the cell itself. They are composed of microtubules (consisting of proteins). Cilia are short, hair-like and move like oars; flagella are long, tail-like and move like whips.
2. Using a pencil, do a line drawing of an animal cell. Indicate and label as many organelles as possible. (5 marks)



3. The nucleolus is an important structure in the cell:
 - a. Where is it located? appears as a darker region within the nucleus
 - b. What molecule does it produce? mRNA
 - c. What is the function of this molecule? to go to cytosol where it help produce proteins
4. Vacuoles are important organelles in the cell:
 - a. Where are they located? within the cytosol
 - b. What are their functions? storage of nutrients, water and waste
 - c. How are they different from vesicles? larger, vesicles job is to transport proteins and lipids within, into and out of the cell
5. Hydrolytic enzymes are very important to cellular function:
 - a. What organelle are they predominantly found in? lysosomes
 - b. What are some of the key functions of this organelle? Digestion - fuse with vacuoles containing food, damaged organelles or pathogens such that the contents can be digested by hydrolysis
6. Compare and contrast the structure and functions of the smooth ER and the rough ER.
 - = smooth ER is not associated with ribosomes and produces lipids such as phospholipids which help form cell membranes and steroids which are used as chemical messengers throughout the body. Smooth ER is also responsible for the detoxification of harmful metabolic byproducts.
 - = rough ER has ribosomes attached and produces, modifies and transports proteins destined for particular organelles, the cell membrane and/or secretion
7. Why do cells of the testes, liver and adrenal glands have extensive amounts of smooth ER?
 - = testes produce the steroid hormone, testosterone
 - = liver functions to detoxify drugs and alcohol found in the blood
 - = adrenal gland produces a variety of steroid hormones such as aldosterone and cortisol
8. Thinking of the various organelles and their associated functions, list 5 activities that **all** animal cells must perform to stay alive.

Answers may vary but may include the following:

- = all cells must be able to store, transmit and apply genetic information to stay alive (via nucleus; note that red blood cells lack a nucleus and these functions and as such only live for 120 days and must be formed from a different cell type called the myeloid progenitor cell)
- = convert glucose to ATP to provide energy for energy-dependent cellular reactions (via mitochondria)
- = produce proteins (via ribosomes)
- = process, package and sort proteins destined for particular organelles, the cell membrane and/or secretion (via Golgi apparatus)
- = transport proteins and lipids within, into and out of the cell (via vesicles)

CELL STRUCTURAL INTERDEPENDENCE

1. Please explain how the following organelles assist each other by working together:
 - a. ribosomes and Golgi bodies
 - = ribosomes produce proteins including those destined for particular organelles, the cell membrane or secretion...the Golgi apparatus then processes, sorts and packages these proteins so that they can be delivered to their final destinations by vesicles
 - b. lysosomes and vesicles

= vesicle deliver enzymes such as hydrolases to the lysosome so that it can function properly
 = as well, vesicles bring particles into the cell and then fuse with the lysosome so that these particles can be digested by hydrolysis

c. nucleolus and ribosomes

= nucleolus produces ribosomes which are necessary to produce proteins within the cell

d. endoplasmic reticulum and ribosomes

= some ribosomes are attached to the ER such that they can "inject" proteins into the ER as they are being made so that the ER can further process and transport the protein towards the Golgi apparatus and its final destination of a particular organelle, the cell membrane and/or secretion

e. cell membrane and cytoskeleton

= the cytoskeleton helps to support the cell membrane and allows the cell to be dynamic in that the cytoskeleton can be remodeled/reshaped beneath the cell membrane such that the cell itself is remodeled/reshaped such as is necessary during endocytosis or cell movement

f. mitochondria and all other organelles

= the mitochondria converts glucose to ATP which is necessary to perform the energy-dependent cellular reactions that occur in all other organelles

INTRODUCTION

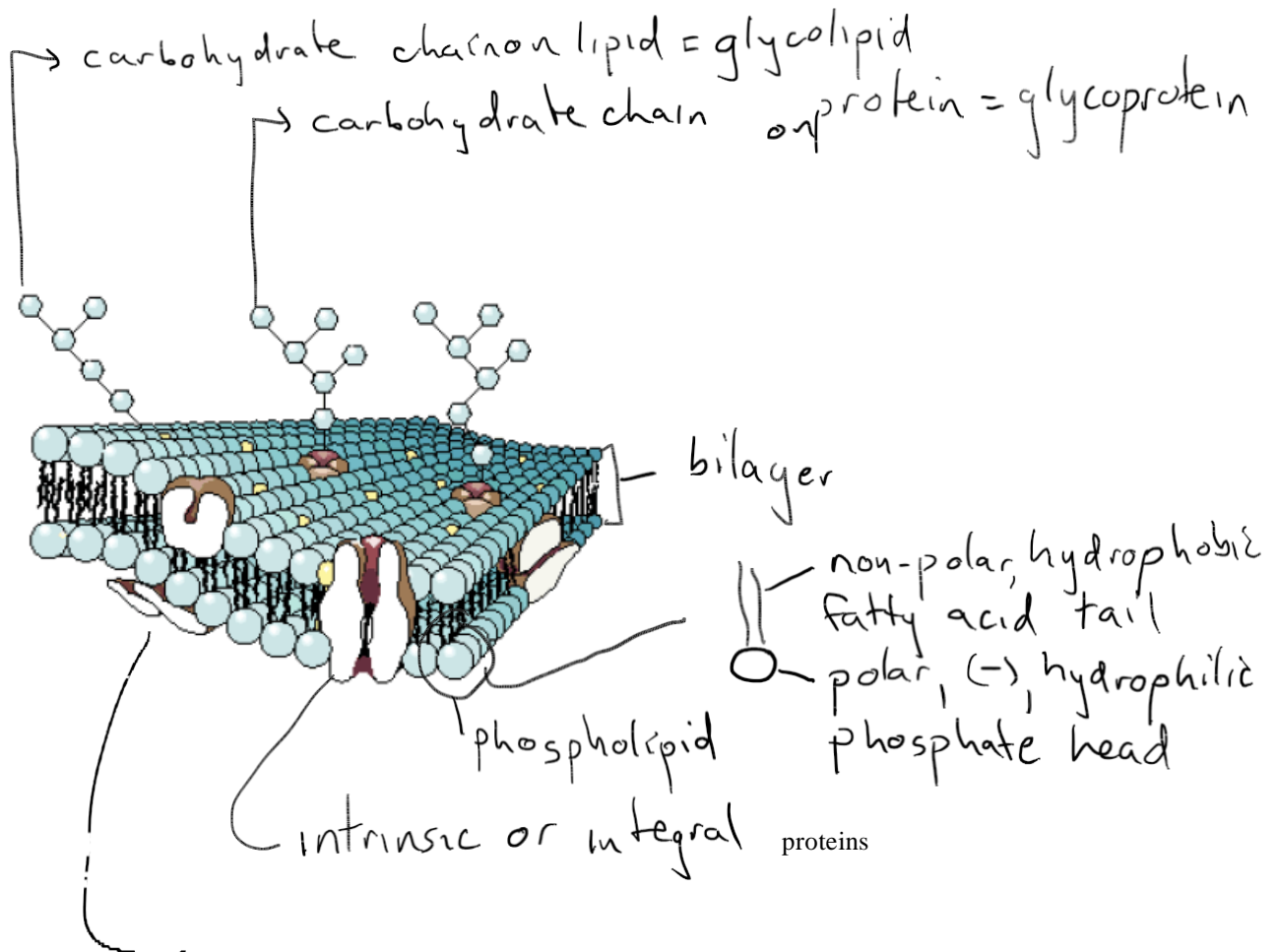
1. Describe the fluid mosaic model.

= states that the cell membrane (aka the plasma membrane) is made up of a semi- fluid (dynamic and changing) phospholipid bilayer with a variety of proteins floating within that bilayer

2. What prefix is used to indicate a protein or lipid that has a carbohydrate chain attached?

= glycol as in glycoprotein
 glycolipid

3. Please label the following cell membrane diagram with as much detail as possible.



Proteins

CELL MEMBRANE FUNCTION

1. Please define the following terms and provide one example where it is involved in transporting a substance in the human body:
 - a. diffusion = the movement of particles from areas of higher concentration to areas of lower concentrations with the concentration gradient, no membrane, carrier or ATP required.
 - b. osmosis = the movement of water molecules from areas of high water concentration to an area of low water concentration across a semi-permeable membrane until equilibrium is met. No carrier or ATP is required.
 - c. facilitated transport = any form of diffusion that requires the assistance of a carrier or channel protein, Movement occurs with the concentration gradient so no ATP is required
 - d. active transport = any form of transport against the concentration gradient that requires energy (typically supplied in the form of ATP). A membrane and a carrier are required.
2. There are several ways to transport substances across the cell membrane. Please complete the table below, indicating whether the form of transport requires a membrane, carrier, energy in the form of ATP, and is with the concentration gradient.

Type of Transport	Membrane Required (Y or N)	Carrier Required (Y or N)	Energy/ATP Required (Y or N)	With concentration Gradient (Y or N)
Diffusion	N	N	N	Y
Osmosis	Y	N	N	Y (with respect to water moving from areas of higher water to areas of lower water)
Facilitated Transport	Y	Y (or channel)	N	Y
Active Transport	Y	Y	Y	N (against the concentration gradient)

3. Which mode of transport is used to move the following molecules across the cell membrane? (4 marks)
 - a. oxygen molecules Diffusion
 - b. water Osmosis

c. sodium ions facilitated or active

d. glucose facilitated or active _

4. Why is the cell membrane important to the cell?

- = defines the boundaries of the cell from the surrounding environment
- = protects the cell - controls what enters and exits the cell

5. What factors influence the rate at which specific molecules diffuse across the cell membrane?

Answer should include any 3 of the following:

- = surface area...greater surface area = faster diffusion
- = temperature...higher temperature = faster diffusion
- = concentration gradient...greater gradient (the greater the difference between the higher and lower concentration areas) = faster diffusion
- = size of diffusing particle...smaller particle = faster diffusion
- = diffusion medium...solid=slower, liquid = faster, gas = fastest

6. Compare isotonic, hypertonic and hypotonic and the effect of a cell being placed in each solution.

- =isotonic = equal concentration inside and outside the cell; no net movement of water by osmosis
- =hypertonic = higher concentration of solution outside the cell; water leaves cell by osmosis causing cell to shrink
- =hypotonic = lower concentration of solution outside the cell; water enters cell by osmosis causing cell to swell and possibly burst (lysis)

7. Why does winter road salt cause damage to plants on the roadside?

- = the excess salt mixes with water in the environment and essentially places the plant in a hypertonic solution that then causes water to exit the plant cell thereby damaging the plant

8. Salting fish was a common practice. How did this practice prevent the fish from rotting?

- = the excess salt mixes with water in the environment and essentially places any potential bacteria that could lead the fish to rot in a hypertonic solution that draws the water from the bacteria causing it to die

9. Compare and contrast endocytosis, including both phagocytosis and pinocytosis, and exocytosis.

Include an example of the use of each process in the body.

- = endocytosis and exocytosis both active transport processes that use ATP and vesicles to transport substances

= endocytosis specifically refers to the use of vesicles to actively move substances into the cell and includes phagocytosis or "cell eating" whereby larger particles are brought into the cell and pinocytosis or "cell drinking" whereby fluids and smaller particles are brought into the cell; also includes receptor-mediated

= exocytosis specifically refers to the use of vesicles to actively move substances **out of** the cell.

= phagocytosis...uptake of bacteria pathogens for destruction within the cell

= pinocytosis...uptake of nutrients by cells in the small intestine

= exocytosis...collagen and plasma membrane lipids

10. Given the image shown, use what you have learned about osmosis to determine the movement of water this system. Assume the semipermeable membrane will not allow the larger solute molecules to pass through.

= The due to the right side of the tube being hypertonic to the left, water will move by osmosis to the right side of the tube. The water level will rise on the right but lower on the left. The concentration of the solution will decrease on the right.

