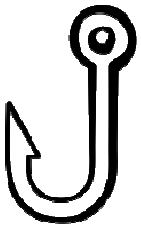
Unit 2: Cellular Chemistry, Structure, and Physiology

Module 3: Cellular Structure

NC Essential Standard:
- 1.1.1 Summarize structure and function of organelles in eukaryotic cells
- 1.1.2 Compare prokaryotic and eukaryotic cells in terms of general structures and degree of complexity

Since every living thing is made of cells, does that mean bigger organisms (like whales or elephants) have bigger cells?



- Not really!
- All organisms, no matter how tiny or how large are composed of cells.
- There are different TYPES of cells (ex. Skin, bone, muscle, nerve), but all cells of a particular type are essentially the same size.
- Therefore, the difference in cells in large vs. small organisms is the NUMBER of cells, not the SIZE!

I. How were cells discovered?

A. New technologies lead to new discoveries

1. _____ – Invented the first microscope and was the first to observe and name the small units that make up organisms. He called those small units **cells** because of the appearance of the structures in the dead cork he observed.
2. _____ – Improved the microscope and procedures for observing cells. He was able to clearly see living cells when observing the scrapings from his teeth.

Cells observed by…
Hooke:

Leeuwenhoek:

B. Through the cooperative efforts of many individual scientists, a unifying **cell theory** developed:

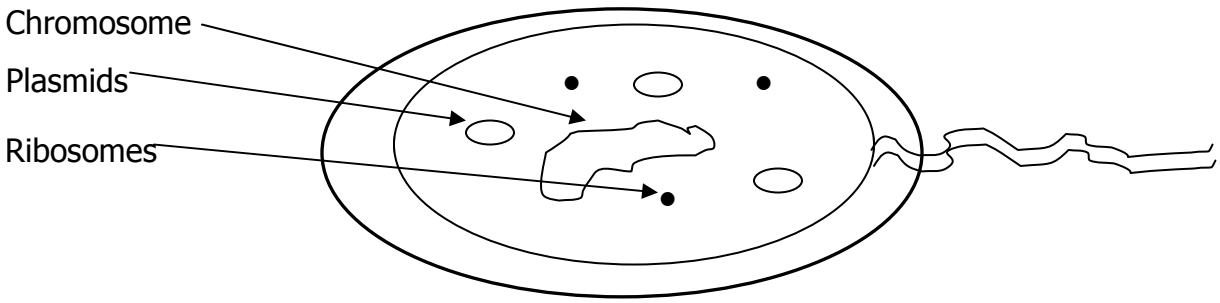
1. All organisms are _____.
2. Cells are the _____ of organisms.
3. All cells come from _____.

II. Are all cells alike?

A. Two main types of cells

Watch It!

1. **Prokaryotic** Cells
   a. _____ type of cell.
   b. Includes only _____.
   c. Structure of a prokaryotic cell
      i. No _____
      ii. No membrane bound organelles
      iii. Includes: _____ (DNA), **plasmids** (smaller rings of DNA), and _____.



Prokaryotic	Eukaryotic

2. **Eukaryotic** Cells
   a. More _____than prokaryotic cells
   b. Includes protist cells, fungi cells, _____ cells and _____ cells (i.e. – everything EXCEPT bacteria cells)
   c. Structure of a eukaryotic cell
      i. _____ contained within a nucleus
      ii. In addition to ribosomes contains _____ _____

B. Cell Specialization

1. Different cells have different specialized structures and different specialized functions. The specialized function of the cell depends on the _____ of the cell.
   Ex. Fresh water vs. salt water environments

Drawing of nerve cell:

2. The specific form (structure) of a cell allows it to perform a specific function – **FORM RELATES TO FUNCTION.**

Ex. _____ have branching dendrites attached to the cell body to receive messages, and a long, thin axon attached to the cell body to transmit messages

Check Yourself!

1. Who first observed dead cells? Who first observed living cells?
2. What are the two main types of cells?
3. How is the location of the DNA different in prokaryotic and eukaryotic cells?
4. What is cell specialization?
5. In cells, form relates to _____.

III. What do cells share?

A. Structures found in ALL cells

1. **DNA** organized as **chromosome**(s). DNA _____ _____.
2. **Cytoplasm** is the "_____" of the cell and is made of up to 90% water. Water provides the necessary environment for all the _____ the cell needs.
3. **Ribosomes** are organelles that are the _____ _____. Proteins are essential for enzymes, structure and communication.
4. **Cell membrane** (_____)

4 structures found in ALL cells:

1.

2.

3.

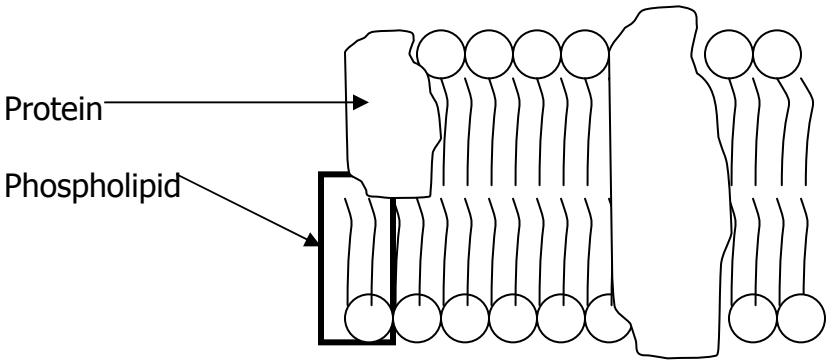
4.

a. Composed of a **phospholipid bilayer** with embedded proteins. The _____ describes the structure of the cell membrane.
   i. Fluid – Individual phsopholipds and proteins can move past each other; they are _____ in one position.
   ii. Mosaic – The membrane has _____ ___ of molecule (phospholipids and proteins)

b. Functions of the cell membrane
   i. **Selectively permeable** – regulates what _____ the cell. This helps maintain homeostasis.
   ii. Gives the cell (cytoplasm) _____.

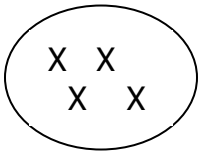
The cell membrane is also called….

and is….
S_____
P_____



B. Structures (**organelles**) found in EUKARYOTIC cells

1. **Nucleus**- _____ for additional protection; is made of a phospholipid bilayer



Organelle means….

2. **Mitochondria** – site of _____ which produces cell energy (ATP). Structure contains _____ _____ which increases surface area allowing more space for more reactions.

Summary of structure/function:

Nucleus –

Mitochondria –

Vacuole –

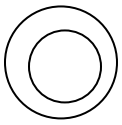
Lysosome –

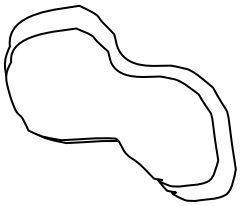
ER –

Golgi –

Chloroplast -

3. **Vacuoles** – _____ to be used inside the cell or excreted from the cell. Size differs in plant vs. animal cells.

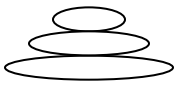




4. **Lysosomes** – contain _____ which digest food contained in vacuoles as well as old or damaged cell parts

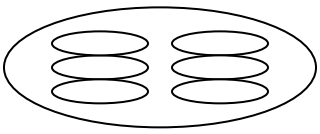
5. **Endoplasmic Reticulum** (ER) – a series of interconnected folded membranes that function in modifying (changing) proteins, detoxification of alcohols, and _____.

6. **Golgi Complex** – _____ materials for export from cells.



C. Structures found ONLY in plant and plant-like cells

1. **Chloroplasts** – organelles full of chlorophyll that are the site of _____ which produces sugars ($C_6H_{12}O_6$); composed of folded membranes for more _____.



Plant only	**Animal only**

2. **Cell wall** – provides _____ _____; found outside the cell membrane and made of cellulose.

D. Structure found ONLY in animal cells

Centrioles – organelle that helps with _____ in animal cells.

Check Yourself!

1. What four structures are found in all cells?

2. What is the function of the mitochondria?

3. What is the function of a ribosome?

4. What term refers to small cell structures?

5. What two structures are found in plant and plant-like cells?

IV. How do cells communicate with other cells?

A. Cells must communicate with other cells in order to _____ _____. The signal usually causes a change in the target cell.

Ex. Neurons (nerve cells) must stimulate muscle cells.

Ex. Brain cells must signal liver cells to release stored sugar

B. Type of communication depends on the distance between cell sending message and receptor (target) cell.

1. Short Distance Communication

a. Some cells are _____ to each other at **junctions**. This allows one cell to send a _____ or _____ message directly to the next cell.

Drawing of….

Cell Junction

Synapse

Ex. One heart cell uses an electrical impulse to stimulate neighboring heart cell to contract

b. Some cells are separated by a _____ called a **synapse**. These cells (typically nerve cells) release a _____message into the synapse and the other cell receives the message using special receptors.
Ex. Pain receptor nerve cell sends message to spinal cord nerve causing reflex reaction.

2. Long Distance Communication
   a. Some cells are so far away they must use a _____ _____ such as the blood. Often _____ are used in this type of communication.
   Ex. A hormone released from the brain stimulates uterine muscle cell contractions during child birth.
   b. When long-distance communication is used, the signal must be _____ so that only the target cell will receive the signal. This involves the shape of the hormone and the shape of cell membrane proteins.

Long distance cell communication uses _____ to affect _____ cells.

Check Yourself!

1. Name two ways cells that are close to each other communicate.

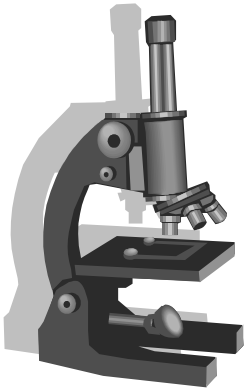
2. What is the function of a hormone?

V. How can we observe cells?

A. Compound Light Microscope

1. Has _____ – **ocular** (eyepiece) and **objective**
2. In order to be viewed, specimen must be ____(so the light may shine through the specimen) and placed on a slide.

Label the ocular lens and the objective lens:



3. Specimen may be _____ to better see structures

B. Electron Microscope

1. Uses _____to produce an image
2. Types:
   a. Scanning Electron Microscope (**SEM**)
      i. Electrons scan the surface of a specimen
      ii. Produces a _____
   b. Transmission Electron Microscope (**TEM**)
      i. Designed to look at structures inside a cell
      ii. Capable of _____

C. Limitations of microscopes

1. **Magnification** is limited by the strength of the lens.
   a. Calculating magnification:

      _____ = total magnification

   b. Example:

      Ocular (10x) x objective (40x) = 400x

2. As magnification increases **resolution** (_____) decreases.

Check Yourself!

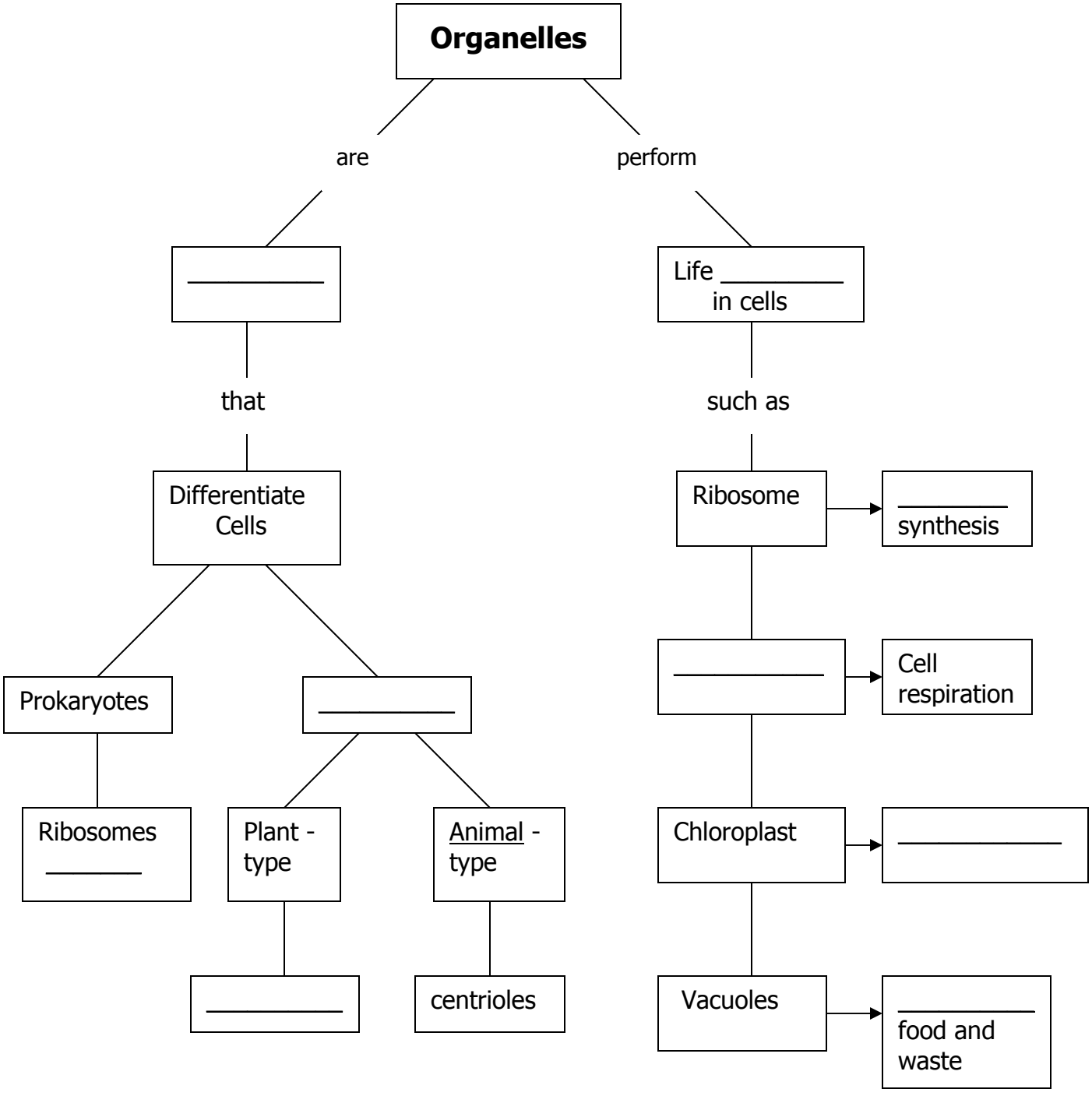
1. Why must specimens be thin for a compound light microscope?

2. Which microscope provides the highest possible magnification?

3. If the ocular lens is 10x and the objective lens is 10x then the total magnification is?

4. As magnification increases resolution _____.

Concept Map: Cell Structure

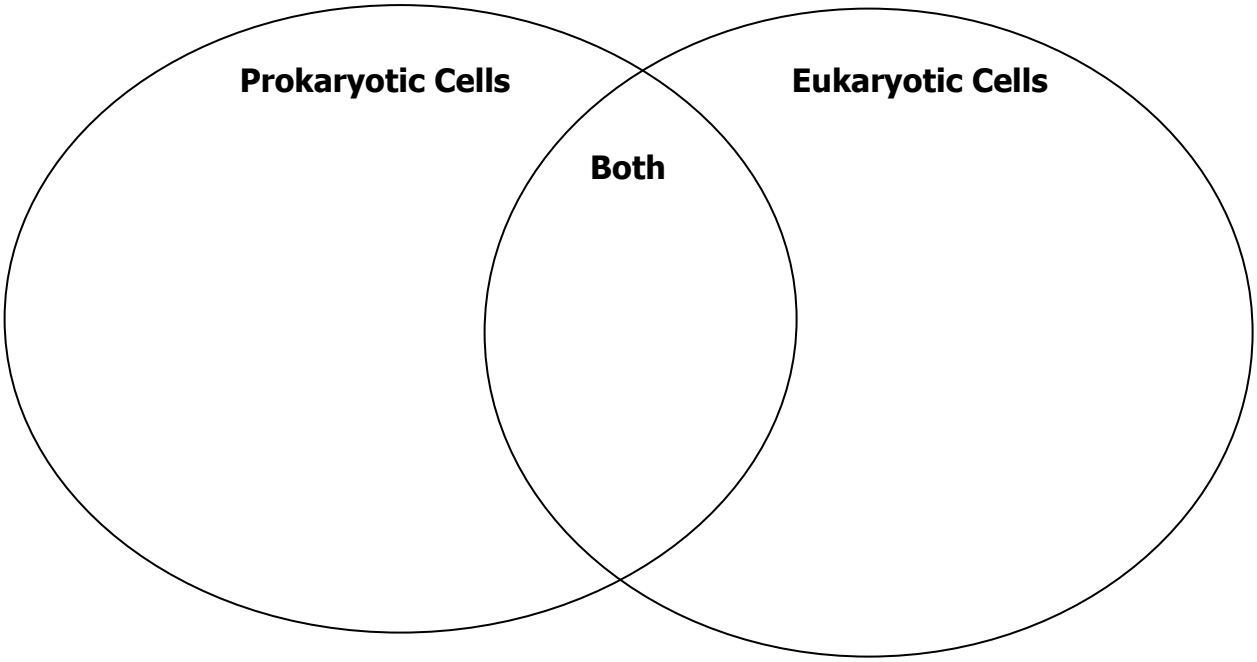


Word Bank:	
Animal	Only
Chloroplast	Photosynthesis
Eukaryotes	Protein
Functions	Store
Mitochondria	Structures

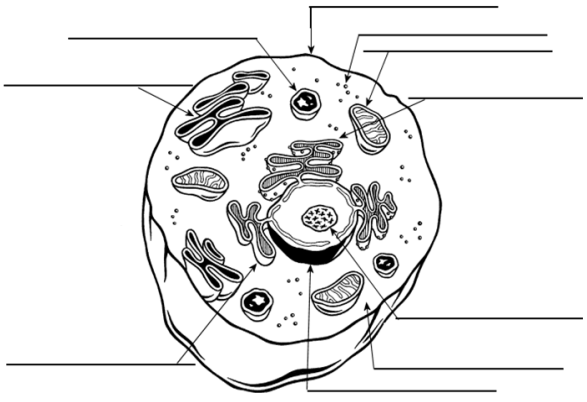
Unit 2 / Module 3
Problem-Solving Set

1. Place the following terms in the correct area of the Venn diagram for cell types using the word bank below:

Nucleus	Cell Membrane	Cell Wall
Ribosome	Mitochondria	Cytoplasm (cytosol)
Golgi body	Vacuoles	Endoplasmic Reticulum
DNA	Plasmid	Lysosome



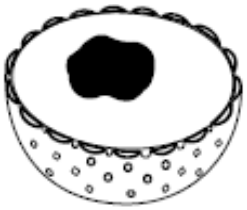
2. Label the cell below.



Explain why this cell is considered EUKARYOTIC.

_____
_____
_____
_____
_____

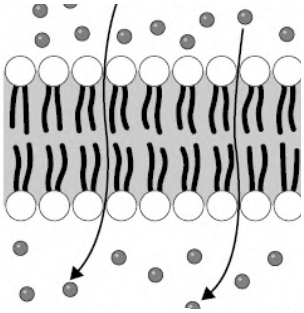
3. Match the pictures of different cell structures to the correct name.



a

b

c



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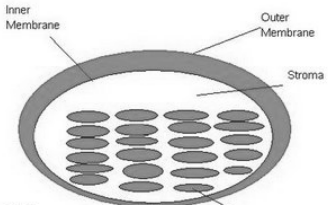


e

1. Mitochondria _____
2. Chloroplast _____
3. Endoplasmic Reticulum _____
4. Plasma Membrane _____
5. Nucleus _____

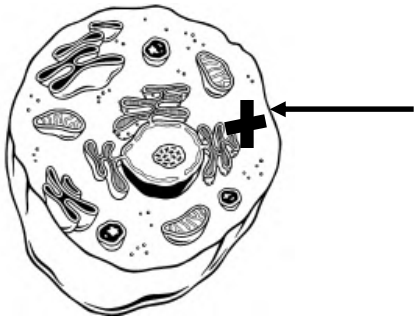
4. Identify the cell structure that matches the function

_____ converts solar energy to chemical energy	a. nucleus
_____ converts stored chemical energy to ATP	b. vacuole
_____ digests larger food particles and wastes	c. ribosome
_____ stores food, water, or waste	d. mitochondria
_____ location of protein production	e. chloroplast
_____ regulates what enters and leaves the cell	f. lysosome
_____ contains chromosomes	g. cell membrane

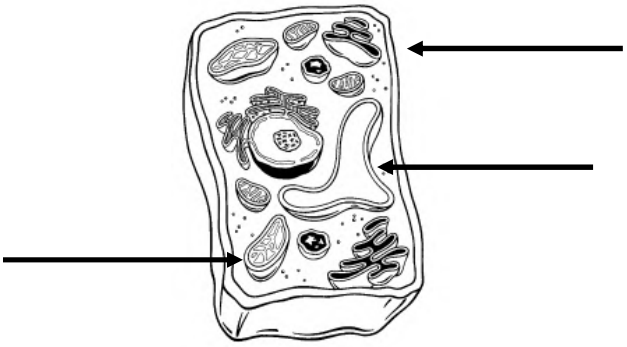
Image Credits:
http://www.ivytech.net/twmurphy/text_pg/pro_cell.jpg
Prentice Hall Review Book – Version B
http://www.cs.utexas.edu/users/almstrum/cs373/s2s/cs373-class/s2s/latest/recursion1/images/doc/cell_euk.gif

5. Label the plant and animal cells below with the distinguishing structures indicated by arrows.

Animal Cell



Plant Cell



6. Identify the cell structure that would be most useful for the proper functioning of the cells below.

_____a. White blood cells must capture and digest invading pathogens.

_____b. Liver cell of a human must be able to detoxify substances ingested and therefore requires a large network of tubules for surface area to break down toxins.

_____c. Cactus plant cells are adapted for storage of large amounts of water in case of drought.

_____d. Plant cells in the leaves face the sun and produce large amounts of carbohydrates for use in winter.

_____e. Red blood cells must make massive amounts of hemoglobin (a protein) that is necessary for your cells to carry oxygen.

_____f. Muscle cells of your upper arm need lots of energy to contract during the day.

_____g. Cells of the digestive tract that secretes digestive enzymes, produce and package vacuoles of digestive enzymes for secretion into the small intestines.

7. Identify the type of communication the cells below might use.

Junctions Synapses Transport System

a. When someone pinches the skin on your arms, your skin stays connected. _____

b. When you grow (increase in height) the message must be received by many different tissue types all over the body (ex. bone, skin, muscle). The signal for this growth is sent out via a growth hormone.
_____

c. In order for your muscles to contract, the muscle cell must be stimulated by a nerve. The nerve and muscle cell do not touch, a chemical messenger carries the signal a very short distance.
_____