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Biology 12 - The Cell

 Part A: In **ONE** sentence, in the space provided, describe the function of the following organelles. **Use point form.** Use your own words. **Paraphrase** and **condense** the textbook definitions. **DO NOT** copy any definition or part of a definition. In the box to the left of each definition, make a **sketch** of the organelle.

	1. cell membrane: <i>control what goes in and out of cell, forms barrier with outside environment</i>
	2. cell wall: <i>structural support in plant cells.</i>
	3. centriole: <i>in animals, function in cell division</i>
	4. chloroplast: <i>in plants, contain photosynthetic pigments that turn light, CO₂ and H₂O into glucose</i>
	5. chromosome: <i>packaging of DNA in nucleus. Functions in cell division</i>
	6. cilia: <i>on outside of cell, move materials past cells (e.g. in bronchi and kidney tubules) or used in locomotion.</i>
	7. cytoskeleton: <i>internal framework of m.t. and m.f. that move substances in cell and anchor organelles.</i>
	8. flagella: <i>used for locomotion in sperm cells and some single celled organisms</i>
	9. Golgi body: <i>for packaging, modification, secretion of substances for export inside and outside the cell.</i>
	10. lysosomes: <i>contain hydrolytic enzymes for digesting foods, destroy wastes, autodigestion</i>
	11. microfilament: <i>fibrous protein filaments used for structural support (e.g. cytoskeleton) and anchoring.</i>
	12. microtubule: <i>tubes of protein monomers used in cilia, flagella, cytoskeleton</i>
	13. mitochondria: <i>make energy for the cell by converting O₂ and glucose to CO₂, H₂O and ATP</i>
	14. nucleolus: <i>site of rRNA production and ribosomal subunit assembly in nucleus.</i>
	15. nucleus: <i>contains DNA, controls cell activities including cell division.</i>
	16. plastids: <i>pigment containing vesicles in plants that function in photosynthesis. Most famous plastid is the chloroplast.</i>
	17. ribosome: <i>site of protein synthesis</i>
	18. rough endoplasmic reticulum: <i>anchors ribosomes in protein synthesis, accepts and modifies newly transcribed proteins and sends to Golgi apparatus</i>
	19. smooth endoplasmic reticulum: <i>lipid synthesis; detoxification</i>
	20. vacuoles: <i>large vesicles. In plants, function to store water and nutrients, help support plant due to Turgor pressure</i>
	21. vesicle: <i>membrane-bound sacs for transporting materials in, around, and out of the cell, also used for storage of various materials.</i>

Part B: Mix and Match! Each definition has only one correct matching answer

G	1. internal framework that anchors organelles, gives shape	A) cell membrane
L	2. cellular "ropes" made of repeating units of the protein <i>actin</i>	B) cell wall
K	3. hollow tubes for transport, movement, made of actin & tubulin proteins	C) centriole
I	4. vesicles pinch off these structures; proteins modified and packaged here	D) chloroplast
J	5. cellular "stomach"	E) chromosome
A	6. selectively permeable "doorman"	F) cilia

D	7. the most important plastid, turns CO ₂ , H ₂ O, sunlight into glucose	G) cytoskeleton
T	8. membrane-bound spheres that store water & dissolved materials. Membrane surrounding it is called a <i>tonoplast</i> . Plants have a large, central one.	H) flagella
N	9. site of rRNA production in nucleus	I) Golgi body
E	10. rod-like structures that package the DNA into neat, discrete units; play role in cell division	J) lysosomes
F	11. used for movement, and to move material past cell. Beat back and forth like little oars	K) microfilament
S	12. site of lipid synthesis	L) microtubule
R	13. appearance due to being peppered with ribosomes; this membranous network receives the just-synthesized protein and may modify it	M) mitochondria
O	14. the "brain" of the cell	N) nucleolus
M	15. this organelle has a double membrane and converts glucose and O ₂ to produce energy in the form of ATP	O) nucleus
B	16. enclose plant cells. Strong cellulose fibers give rigidity	P) plastids
P	17. small organelles in plants that contain pigments or store starch	Q) ribosome
U	18. small membranous spheres that transport materials around cell, out of cell via exocytosis, and into cell via endocytosis	R) rough endoplasmic reticulum
Q	19. made of rRNA and protein, these small, numerous organelles are the site of protein synthesis	S) smooth endoplasmic reticulum
C	20. twin barrel like structures in animal cells that play a role in cell division; have 9 + 0 arrangement of microtubules	T) vacuoles
H	21. whip-like structures used for movement in unicellular organisms; have 9 + 2 arrangement of microtubules	U) vesicle

Part C: Short Answer

1. What component of the cell membrane causes it to have a FLUID consistency? **PHOSPHOLIPIDS** What component causes it to be like a mosaic? **PROTEINS**.
2. The cristae in mitochondria are the location for **enymes** involved in **cellular respiration**.
3. List the 3 main classes of microscopes and in the box underneath, list the most important distinguishing characteristic of each type of microscope.

light microscope	transmission electron	scanning electron
low resolving power due to light λ	highest magnif., very thin sections	produces 3D images

4. The nucleus is enclosed by the **nuclear envelope**, which contains **pores** that open into the cytoplasm.
5. The three organelles enclosed by a double membrane are:

nucleus	mitochondrion	chloroplast
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6. Describe the relationship between nucleoli and ribosomes:

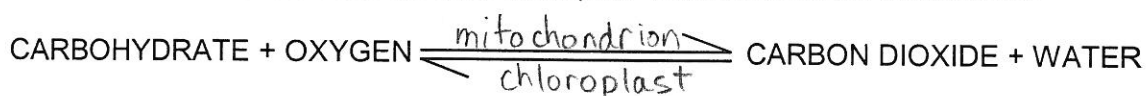
The RNA in the nucleoli becomes structural part of ribosomes

7. DNA within the nucleus controls what (be specific)? **protein synthesis**
8. Study the table below and answer the following questions:

Unit of Measurement	Symbol	Seen By
centimeter	cm = 0.01 m	Naked Eye
millimeter	mm = 0.001 m = 0.1 cm	Naked Eye
micrometer	μm = 0.000001 m = 0.001 mm	light microscope
nanometer	nm = 0.000000001 m = 0.001 μm	electron microscope

Which of the cell organelle could be seen with

- a. the naked eye? **none**
 - b. the compound light microscope? **nucleus**
 - c. the electron microscope? **all of them**
 - d. Most cells are between **1 μm** and **100 μm** in diameter.
9. Copy the following equation into your notes; then write the word "mitochondrion" above or below the correct arrow in the reaction. Write the word "chloroplast" above or below the correct arrow.



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10. Place these terms in the appropriate column below: centrioles, cell membrane only, cell membrane and cell wall, large central vacuole, small vacuoles only, mitochondria only, mitochondria and chloroplasts, lysosomes, plastids.

Animal	Plant
centrioles	cell membrane and cell wall
Mitochondria only	large central vacuole
small vacuoles only	mitochondria and chloroplasts
cell membrane only	plastids
lysosomes	

11. How do these organelles work together?

a. **lysosomes** and **vacuoles**

vacuoles may contain a substance that can be digested after fusion with lysosomes

b. **endoplasmic reticulum** and **Golgi apparatus**

products produced at the E.R. are sent to Golgi apparatus for repackaging and secretion

c. **centrioles** and **cilia**

centrioles become basal bodies that produce cilia

d. **ribosomes** and **endoplasmic reticulum**

proteins are made at the ribosomes located on endoplasmic reticulum. ER then modifies & temporarily stores proteins.

e. **chloroplast** and **mitochondria**

carbohydrate made in the chloroplasts is broken down in the mitochondria

12. Prokaryotic compared to eukaryotic cells. Fill in this table by writing *yes* or *no* on the lines provided.

	Prokaryotic (e.g. bacteria)	Eukaryotic (e.g. humans)
a. cell membrane	yes	yes
b. cell wall	yes	no
c. nuclear envelope	no	yes
d. mitochondria	no	yes
e. endoplasmic reticulum	no	yes
f. ribosomes	yes	yes
g. centrioles	no	yes

13. Plant cells a) have a cell wall but no cell membrane b) have chloroplasts but no mitochondria c) do not have any centrioles and yet divide d) have a large central vacuole but do not have endoplasmic reticulum.

14. How are mitochondria like chloroplasts? a) they have the same structure b) they both absorb the energy of the sun c) they are both concerned with energy d) they are both found in all cells

15. Which type of molecule forms a bilayer within the membrane? a) carbohydrate b) protein c) lipid d) nucleic acid

16. Which organelle doesn't contain membrane? a) mitochondria b) lysosomes c) Golgi apparatus d) endoplasmic reticulum e) ribosomes

17. Which of the following does not contain nucleic acids? a) chromosomes b) ribosomes c) chromatin d) centrioles e) genes

18. Which of the following is considered to be the greatest advantage of the electron microscope over the light microscope? a) its maximum magnification power is 2000X. b) its resolving power is increased by almost a thousand fold. c) its image may be used to produce a photographic plate d) the observer may look directly at the screen instead of through eyepieces.

19. Which of the following cell structures within the cytoplasm is connected to the nuclear envelope? a) the nucleolus b) chromatin c) endoplasmic reticulum d) vacuoles e) lysosomes

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20. When secretory products are transported to the cell membrane for export, a) they move enclosed in a vesicle derived from the Golgi apparatus b) they are still attached to ribosomes c) they travel directly to the cell membrane through the rough endoplasmic reticulum d) all of these

Part D - Please answer the following questions on a separate sheet of paper, in full sentences.

1. If a tiny hole is made in a plasma membrane, it usually "heals" immediately, and no harm results. **What property** of the plasma membrane allows this? *The fluid property of its lipid bilayer*
2. **Lipids, small molecules, and uncharged particles** pass into and out of the cell with **relative ease**. What **characteristics** of the cell membrane can be inferred from these observations? *It is composed largely of non-polar lipids, and contains pores for small molecules*
3. Describe the **Fluid Mosaic Model** of membrane structure. *A bilayer of phospholipids, in which protein molecules are partly or wholly inserted. Lipids are the "fluid", proteins are the "Mosaic"*
4. A **continuous system of membranous channels** is believed to connect the nucleus with the cell membrane. Describe the **structure** and **function** of the organelles prominent in this system.
*Nuclear envelope (membrane): double layer with pores which contains genetic material and nucleoplasm of nucleus; controls substances entering or leaving nucleus,
Endoplasmic reticulum: series of tubular canals extending from the nuclear envelope throughout the cell; protein synthesis in ribosomes attached to rough ER, lipid synthesis in smooth ER, and packaging.
Golgi apparatus: series of hollow flattened membranous sacs; re-package, store, secrete, and modify proteins.
Vesicles: single membrane sac; for storage and transport
Cell membrane: phospholipid bilayer with proteins; acts as the barrier and doorman of the cell.*
5. Why is the **nucleus** centrally positioned in most eukaryotic cells? *Its messages (RNA) need to diffuse to all areas of the cell, so a central location is most logical.*
6. a) Describe the **structure** and **function** of **mitochondria** and **chloroplasts**.
*Mitochondria: double membraned with inward folds of inner membrane called cristae and fluid interior called matrix. Cristae are lined with enzymes used in the cellular respiration of glucose and oxygen to produce carbon dioxide, water, and ATP energy.
Chloroplasts: double membraned with stacks of thylakoids called grana which contain chlorophyll and are where photosynthesis occurs. Grana are connected by lamella and surrounded by stroma. Photosynthesis converts carbon dioxide and water into oxygen and glucose with the use of sunlight.*
7. An inherited disorder in humans results in the absence of dynein (an important structural protein) in flagella and cilia. The disease causes respiratory problems and sterility in males. What is **connection between these two symptoms**?
Cilia line resp. tract and function to move debris out of lungs. An absence of Dynein means cilia won't form and therefore respiratory problems result as debris collects in lungs. Flagella propel sperm cells. An absence of Dynein means flagella won't form, resulting in sterility in males because their sperm can't swim to fertilize the egg.
8. What are the **two main types of cells** and how do they differ structurally? *Hint: the answer is NOT plant and animal cells!*
Prokaryotic cells have no membrane bound organelles. Eukaryotic cells have membrane bound organelles such as nucleus, mitochondria, chloroplasts, etc. etc.
9. Most animals are **heterotrophs** that can move. Most plants are stationary **autotrophs**. Explain how the differences in the structure of plant and animal cells contribute to these characteristics.
Plants have rigid cell walls so can't move, but are autotrophs so they can make their own food without moving. Animals have no chloroplasts, so must eat other organisms. Have no cell walls, so are flexible.

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10. What challenges face a cell that undergoes a **great increase in size**? How can the cell **overcome** these challenges?

Challenge is that there is a decrease in SA:V ratio (i.e. less membrane to service cell contents). This means it will be difficult for a cell to take in enough nutrients and get rid of enough wastes. Challenge overcome by cells by: dividing; slowing metabolism; changing shape to long and skinny; folding

11. **Vinblastine** is a drug that interferes with the assembly of microtubules. It is widely used for chemotherapy in treating cancer patients. **Suggest a hypothesis** to explain how vinblastine slows tumour growth by inhibiting cell division.

Microtubules form spindle bundle etc. which is necessary for cell division. Vinblastine interferes with m.t. assembly, so it would slow the growth of rapidly dividing cells, such as those in tumours. Of course, it will also affect normal cells, but since they mostly divide more slowly than cancer cells, they would not be as affected.

12. The **Endosymbiotic Theory Of Eukaryotic Cell Origin** states that **mitochondria** and chloroplasts were at one time independent organisms that were "enslaved", so to speak, by an ancient precursor to modern eukaryotic cells. Give some structural evidence in mitochondria that would tend to support this hypothesis.

Double Membrane, self-replicating, own DNA, structure/size similar to prokaryotic cells.

13. Give 3 characteristics you would expect to find in a Protein-secreting cell.

Lots of nucleoli, mitochondria, golgi apparatus, and rough ER