

## Review for Unit Test #2: Cell Parts, Functions and Protein Synthesis

The following animation is an excellent review of the types of transport across a cell membrane:

<http://www.sumanasinc.com/webcontent/animations/content/diffusion.html>

1. Know all of the material on the Review for Cells Quiz #1 (on website).
2. Know and understand the definitions and meanings of the following terms.

ocular lens  
objective lens  
field of view  
nucleic acids  
nucleotide  
chromatin

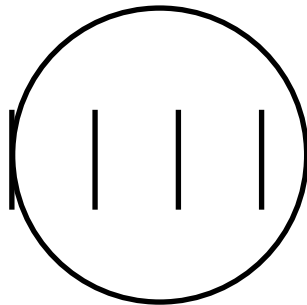
gene  
chromosome  
histones  
DNA replication  
helicase  
DNA polymerase

mutation  
neutral mutation  
point mutation  
frameshift mutation  
mRNA  
codon

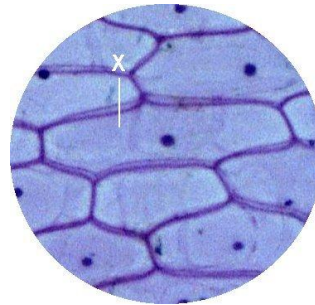
tRNA  
transcription  
translation  
polypeptide  
peptide bond  
protein

3. Be able to perform microscope calculations for total magnification, FOV and estimate the size (width and/or length) of a cell seen under the microscope.

a)



Field of View (Low Power)

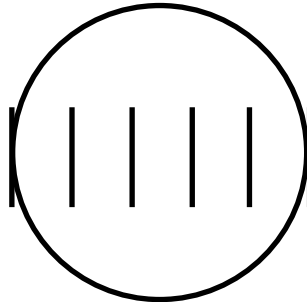


Onion Cells (High Power)

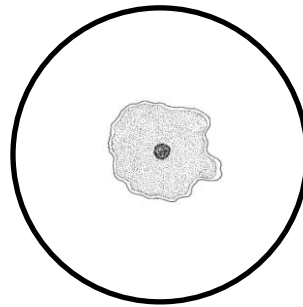
**Microscope Information:**

Ocular lens = 10X  
Objective Lenses:  
low power = 10X  
med. power = 20X  
high power = 40X

b)



Field of View (Low Power)



Amoeba (Medium Power)

**Microscope Information:**

Ocular lens = 10X  
Objective Lenses:  
low power = 5X  
med. power = 10X  
high power = 20X

4. Compare and contrast the following terms (that is, know the similarities AND differences between the groups of terms):

- a) prokaryotic and eukaryotic cells
- b) positive and negative mutation
- c) frameshift and point mutation

- d) DNA and RNA
- e) polypeptides and proteins
- f) DNA and chromatin

5. Regarding nucleic acids:

- a) What are nucleotides?
- b) What three molecules make up nucleotides?
- c) What are three significant differences between the structures of DNA and RNA?
- d) Give three reasons why the structure of the DNA molecule is so well suited to its function.
- e) Describe the steps in DNA replication. Include the names of two enzymes.
- f) A sample of DNA contains 20% cytosine. What are the percentages of the other nucleotides in this DNA?

6. Regarding proteins (you may need to look back at your notes on macromolecules):

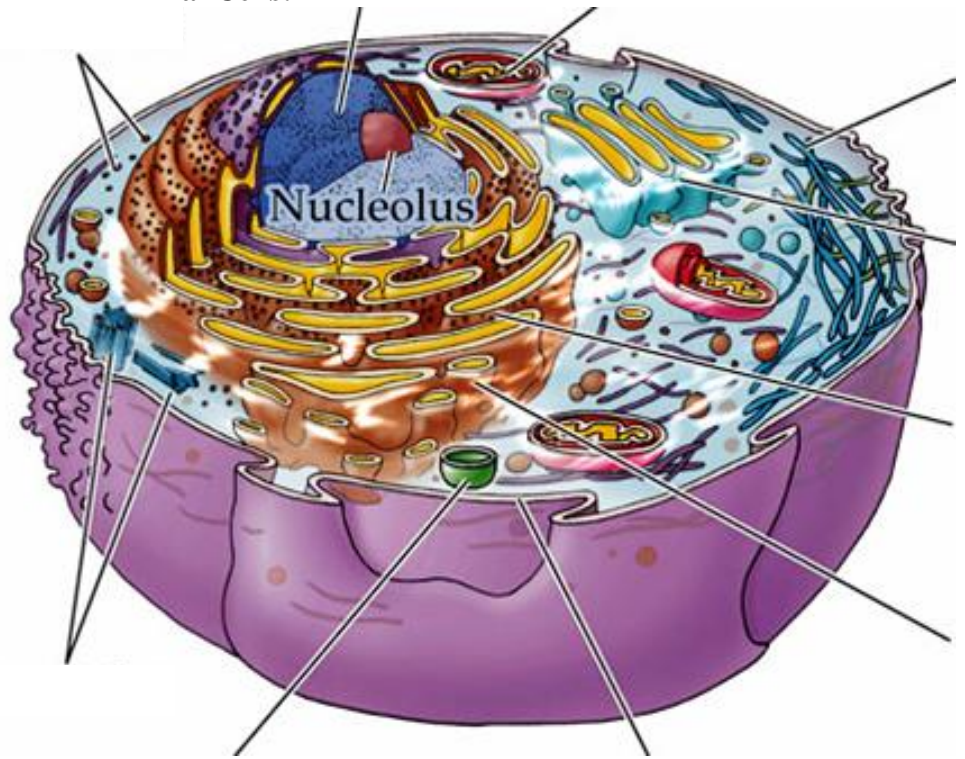
- a) Describe four functions carried out by proteins in living things. Give a specific example for each.

- b) Which organelles in plant and animal cells have a role in protein production?  
c) Protein synthesis is anabolic. What does this mean?  
d) Protein synthesis requires energy. What energy storage molecule supplies this energy? Where is it made?
7. Very briefly outline the steps of protein synthesis that take place in free ribosomes in the cytoplasm.
8. What is meant by transcription? Where does it take place? What happens during this process?
9. What is meant by translation? Where does it take place? What happens during this process?
10. Very briefly outline the roles of the following in protein synthesis:  
a) chromatin                      b) genes                      c) mRNA                      d) tRNA                      e) ribosomes
11. Use the mRNA codon chart in your notes to translate the following DNA strands into mRNA strands and then into a polypeptide chain:
- a) DNA:                      T A C G G G T T A T C G A A A T G T C G A C T G A T C  
mRNA :                      \_\_\_\_\_  
polypeptide:                      \_\_\_\_\_
- b) DNA:                      T A C G C G A C A G T C C A G C A T G G A T T G A C T  
mRNA :                      \_\_\_\_\_  
polypeptide:                      \_\_\_\_\_
12. Referring to the second DNA strand ('gene') in question 11b), what would happen if a mutation changed the ninth (9<sup>th</sup>) nucleotide from an 'A' to a 'U'? How would this affect the cell?
13. Regarding proteins that are manufactured by ribosomes found on the rough endoplasmic reticulum:  
a) Why are some polypeptide chains inserted directly into the endoplasmic reticulum and not released into the cytoplasm?  
b) A cell is making the polypeptide hormone "insulin" to be secreted outside of the cell. Very briefly outline the steps that happen AFTER the polypeptide chain is manufactured and inserted into the centre of the rough ER and BEFORE the insulin can leave the cell.
14. What are the functions of these enzymes: a) helicase              and              b) DNA polymerase?
15. Regarding mutations:  
a) Define or explain what is meant by a mutation.  
b) What are two common types of mutations? Describe what happens in each type of mutation.  
c) If a mutation occurs during mRNA transcription, how will this affect the cell?  
d) If a mutation occurs during DNA replication, how will this affect the cell?
16. A common theme in biology is that "structure dictates function" which means that how a structure or organism is made (its anatomy) influences how it works (its physiology). Describe how the structure of the following organelles affects their function:  
a) mitochondria                      c) rough endoplasmic reticulum  
b) nuclear membrane                      d) lysosomes
17. Cells are the smallest unit of life. What are the characteristics of living things?
18. State one way in which the following organelles are related or work together:  
a) Golgi apparatus and lysosomes  
b) microtubules and vesicles  
c) ribosomes and nucleolus

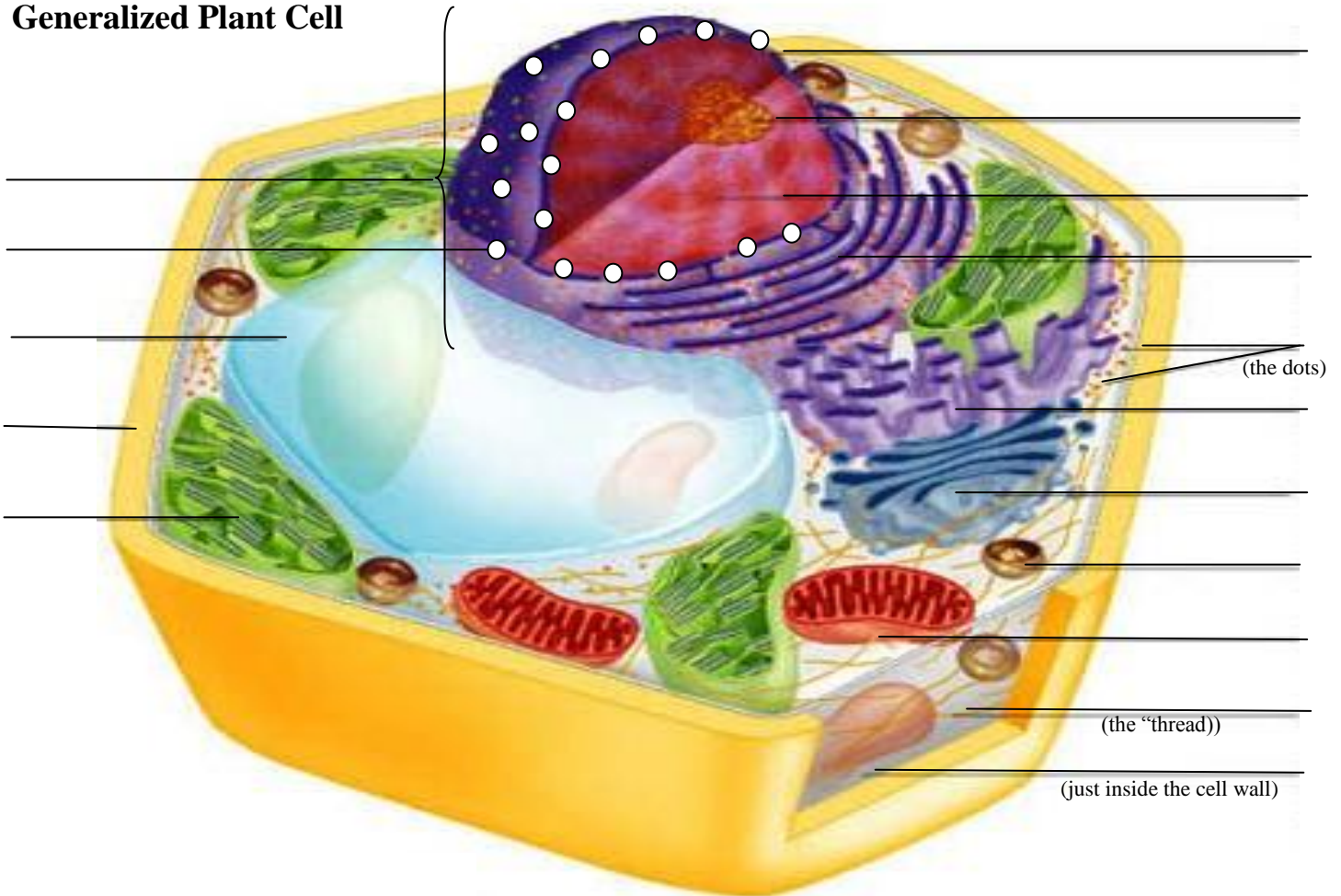
**Label the Generalized Plant and Animal Cells:**

**Generalized Animal Cell**

The organelles are clearer and easier to see on the website.



**Generalized Plant Cell**



**On average, prokaryotes are about 10 times smaller than eukaryotic cells in diameter and about 1000 times smaller than eukaryotic cells in volume.**

### Practice Multiple Choice:

- Prokaryotic cells differ from eukaryotic cells because prokaryotic cells do not have any:  
a) ribosomes                      b) DNA                      c) nucleus                      d) all of these
- Examples of prokaryotic cells include:  
a) bacterial cells                      b) plant cells                      c) animal cells                      d) both 'a' and 'c'
- Seawater contains about 4 times as much solute as blood plasma; blood cells placed in seawater would:  
a) swell as water enters the cell by osmosis                      c) shrink as water leaves the cell by osmosis  
b) gain salt as it diffuses across the membrane                      d) lose salt as it diffuses across the membrane
- Which of the following would diffuse most easily across a cell membrane?  
a) large polar molecules                      c) small polar molecules  
b) large non-polar molecules                      d) small, simple ions
- The rough endoplasmic reticulum functions to:  
a) modify, transport and package proteins                      c) destroy old cell parts  
b) make ribosomes                      d) produce energy for the cell
- In an animal cell, the centrosome is made up of:  
a) both smooth and rough endoplasmic reticulum                      c) two centrioles  
b) the nucleus, nucleolus and chromatin                      d) vacuoles, vesicles, lysosomes and peroxisomes
- The movement of substances into, and out of, the cell is controlled by the:  
a) nuclear pores                      b) cell membrane                      c) cell wall                      d) lysosomes
- The organelle which is important in plant cells for storing water and salts is the:  
a) centrosome                      b) chromatin                      c) central vacuole                      d) peroxisomes
- Modern biology is guided by the Cell Theory, which states that:  
a) all living things arise from other living things                      c) the cell is the smallest unit of life  
b) living things are made of one or more cells                      d) all of the above
- Life is only possible within a carefully controlled environment. This environment is controlled by the:  
a) nucleus                      b) cell membrane                      c) cell wall                      d) cytoplasm
- Cells are usually very small or very flat. This is important to ensure that the cell has:  
a) room for a lot of cilia on the outside                      c) a large enough surface area for diffusion of oxygen  
b) the smallest possible amount of cell wall                      d) all of the above
- Which of the following are visible using a light microscope such as those we have in our classroom?  
a) nucleus and nucleolus                      c) leucoplasts and chloroplasts  
b) cell wall and cell membrane                      d) all of the above
- Both prokaryotic and eukaryotic cells have:  
a) DNA and ribosomes                      c) mitochondria and chloroplasts  
b) a nucleus and nucleolus                      d) all of the above
- Genes are:  
a) found in the cytoplasm                      c) present only when a cell is preparing to divide  
b) the "recipe" for a single protein                      d) all of the above
- The pathway for a protein destined to be released outside of the cell is:  
a) lysosome → rough ER → vesicle                      c) nuclear ribosome → nuclear pore → cytoplasm  
b) rough ER → Golgi body → secretory vesicle                      d) smooth ER → rough ER → mitochondrion
- Pancreatic cells synthesize and export large quantities of digestive enzymes. They must have:  
a) more Golgi bodies than typical cells                      c) more than one nucleus  
b) a large number of lysosomes                      d) more peroxisomes than typical cells



34. Diffusion can occur ONLY:
- if there is energy available as ATP
  - down a concentration gradient
  - in living cells
  - through a channel protein in the membrane
35. Frog eggs placed in an isotonic solution will:
- swell but not burst
  - swell and burst
  - remain the same
  - shrink
36. When placed in a hypotonic environment, a plant cell will:
- swell and burst
  - perform endocytosis
  - shrink and wilt
  - increase in turgor pressure
37. The total concentration of solute in the ICF in a red blood cell is 0.05%. Which ECF will cause cytolysis?
- 0.005% solute
  - 0.05% solute
  - 0.50% solute
  - 5.0% solute
38. In an experiment, frog's eggs were placed in a salt solution. After several hours their volume increased significantly. Compared to the frog's eggs, the solution was:
- isotonic
  - saturated
  - hypotonic
  - hypertonic
39. A cell will tend to gain water if it is moved from:
- an isotonic solution to a hypotonic solution
  - a hypotonic solution to an isotonic solution
  - an isotonic solution to a hypertonic solution
  - a hypotonic solution to a hypertonic solution
40. Which of the following moves material against a concentration gradient?
- osmosis
  - diffusion
  - active transport
  - passive transport
41. Which of the following processes requires energy?
- osmosis
  - diffusion
  - pinocytosis
  - facilitated diffusion
42. When a cell engulfs large protein molecules and takes them into the cytoplasm in vesicles, it is called:
- facilitated transport
  - passive transport
  - exocytosis
  - phagocytosis
43. Muscle cells require large amounts of energy, so they must have many:
- peroxisomes
  - chloroplasts
  - nuclei
  - mitochondria
44. Which of the following organelles were likely acquired by eukaryotic cells through endosymbiosis?
- mitochondria and chloroplasts
  - vacuoles and vesicles
  - rough and smooth endoplasmic reticulum
  - all of the above
45. One function of the rough endoplasmic reticulum is to:
- make polypeptides
  - modify polypeptides
  - make phospholipids and steroid hormones
  - all of the above
46. The cell's cytoskeleton is made of:
- DNA and RNA
  - microtubules
  - chromatin
  - chromosomes
47. Which of the following is important in modifying and packaging proteins?
- Golgi apparatus
  - lysosomes
  - ribosomes
  - mitochondria
48. Diffusion will be most efficient in a cell with a surface area to volume ration that is:
- very large
  - very small
  - equal
  - negative
49. Which of the following is most likely to contain leucoplasts?
- green plant stems
  - flower petals
  - white rice
  - all of these
50. Which of the following is most likely to contain chromoplasts?
- a yellow squash
  - an orange pepper
  - a red beet root
  - all of these

51. Which row is correct?	EUKARYOTIC CELLS	PROKARYOTIC CELLS
a) Ribosomes	absent	present
b) Mitochondria	present	absent
c) Cell membrane	present	absent
d) Endoplasmic reticulum	absent	absent

52. In which part of the cell does protein transcription take place?  
 a) the nucleus                      b) the cytoplasm                      c) the smooth ER                      d) ribosomes
53. The role of DNA polymerase is to help:  
 a) copy DNA to make mRNA                      c) make peptide bonds to join amino acids  
 b) unwind the DNA molecule                      d) bond the sugar-phosphate backbone together
54. The “t” in tRNA stands for:  
 a) transcription                      b) translation                      c) transfer                      d) transport
55. If a sample of DNA contains 30% cytosine (C), what is the percentage of thymine (T) in the sample?  
 a) 30%                      b) 15%                      c) 40%                      d) 20%
56. Which of the following is/are important in order for DNA to perform its functions?  
 a) it is capable of being significantly condensed  
 b) it has a “built in” template for replication  
 c) it can code for more than 20 different amino acids using a combination of only four nucleotides  
 d) all of the above
57. One of the most common forms of cystic fibrosis is caused by:  
 a) a point mutation                      c) a frameshift mutation  
 b) eating too much high fat food                      d) a mother getting a virus during pregnancy
58. A symbiotic relationship is best described as:  
 a) win / win                      b) win / lose                      c) lose / lose                      d) all out war
59. The process of copying a gene from DNA to RNA is called:  
 a) replication                      b) transcription                      c) translation                      d) mutation
60. A DNA strand has the sequence: AACGTAACG. Its matching mRNA sequence would be:  
 a) AACGTAACG                      b) UUGCAUUGC                      c) AACGUAACG                      d) TTGCATTGC
61. A gene is made up of 120 nucleotides. The maximum number of amino acids in the polypeptide chain is:  
 a) 120                      b) 60                      c) 30                      d) 40
62. The function of mRNA is to:  
 a) provide a pattern for polypeptide synthesis                      c) bring amino acids to the ribosome  
 b) unwind and unzip DNA                      d) store the genetic information for the cell
63. In the process of translation:  
 a) a strand of mRNA is made by copying the DNA  
 b) a strand of tRNA is copied from DNA  
 c) a polypeptide is synthesized from the order of the nucleotides on the mRNA  
 d) ribosomes are made in the nucleolus from the order of the nucleotides on the mRNA
64. Transcription produces:  
 a) tRNA                      b) mRNA                      c) ribosomes                      d) polypeptides