Introduction to Cytology

Course
Anatomy & Physiology

Unit III
Cellular Biology

Essential Question
How do cells work?

TEKS
130.206(c)
1A
2B,2C,2E,2F,2G,2H
6A,6B
10A,10B,10C,10D

Prior Student Learning
Basic understanding of body orientation terminology

Estimated time
3 – 5 hours

Rationale
The cell is the basic unit of structure and function. Each cell has a unique shape and function. Some examples of cells include eggs (ova), spermatozoa, muscle cells, nerve cells, and blood cells.

Objectives
Upon completion of this lesson, the student will be able to:
- list and describe the various parts of a cell and explain how their function and diseases are related;
- describe the process of cellular mitosis;
- define neoplasm, and distinguish between benign and malignant neoplasms;
- understand cancer growth and staging;
- describe the different transport systems within the cell; and
- explain cellular respiration and enzyme activity and dysfunction.

Engage
Put the following terms in order from largest to smallest:
- Organism
- Tissue
- Organ
- Cell
- Organelle

Answer:
1. Organism
2. Organ
3. Tissue
4. Cell
5. Organelle

Key Points
I. Cell Overview
   A. Hierarchy of organization
      1. Atoms -- tiny building blocks of all matter
      2. Molecules -- carbohydrates, proteins, lipids, nucleic acids
      3. Organelles -- miniature systems carrying out functions within the cell
      4. Cells -- fundamental unit of living organisms

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II. Cell Structures
   A. Cell Membrane -- a semi-permeable membrane acting to protect the internal cell structures and assist in cell transport
      1. Passive Transport -- requiring no extra energy to transport particles in or out of a cell as in the passively rafting using the current of the river to assist
         a. Diffusion -- passive movement of a particle from a higher concentration to an area of lower concentration like perfume
         b. Facilitated diffusion -- a substance that carries a molecule across; akin to passing a pail of rocks to a person who dumps it empty and returns for more
         c. Osmosis -- the movement of water across a semi-permeable membrane from an area of high solute concentration to an area higher in solute concentration to balance out the water on both sides
         d. Filtration -- different from osmosis in that pressure is applied to move water and its dissolved materials across a membrane, such as when you squeeze a water gun or the blood pressure forcing water and solutes through kidneys
      2. Active Transport -- a method of cell transport requiring extra energy in the form of ATP and a protein to carry molecules across an area already fully concentrated such as rafting against the current of the river
         a. Endocytosis -- the physical movement of a particle into a cell resulting with an enclosed vesicle formed from the enveloping of the cell membrane
         b. Phagocytosis -- cell eating such as white blood cells ingesting bacteria to prevent infections
         c. Pinocytosis -- cell drinking
         d. Exocytosis -- the physical movement of particles out of the cell such as secretion of insulin from pancreatic cells
      3. Diseases related to cell transport
         a. Cystic Fibrosis -- a defect in the membrane channel carrier proteins affecting the simple diffusion of sodium and chloride causing thick mucus production and clogging organs
         b. Diabetes mellitus (DM) -- a disorder of facilitated diffusion where insulin, the carrier molecule for glucose, is not enough or is ineffective to transport into cells; this results in hyperglycemia thus affecting the osmotic pressure of all cells resulting in dehydrating the cells of fluid as glucose concentration increases extracellularly and water is drawn from within the cell. This explains why diabetics frequently urinate with traces or high amounts of glucose in the urine.
c. Familial Hypercholesterolemia -- A genetic disorder of endocytosis where a fatty-protein called Low-Density Lipoprotein (LDL-the “bad” cholesterol) is not transported across the cell membrane together with cholesterol to make other lipids for cell use but rather hangs out in the blood to accumulate and clog the blood vessels

B. Cytoplasm -- the internal formative material needed for cell survival; likened to the egg-white needed for an embryo chick to survive

C. Nucleus -- the brain of the cell that dictates the activities of the organelles within the cell; like “City Hall” controlling the activities of city departments
   1. Chromatin -- found in the nucleus, this material contains the DNA material or “blueprints” needed to make new cells
   2. Nucleolus -- an orbital structure located within the nucleus which synthesizes RNA and ribosomes, the organelles responsible for getting the materials needed to work on cellular infrastructure using our genetic blueprints

D. Ribosomes -- an organelle composed of one-part RNA and one-part enzyme found singly in cytoplasm or on endoplasmic reticulum is the site of cell repair and reproduction; this is compared to a manufacturing company of the building materials used for cell remodel and repair

E. Centrosomes -- the general area containing centrioles, the organelles needed to prepare for the construction of new cells, like building contractors making new buildings; centrioles prepare cell for mitosis

F. Mitochondria -- a cellular power plant, this organelle generates the body’s energy needs by supplying ATP for body processes through the process of cellular respiration:

\[
\text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2 \rightarrow 6\text{CO}_2 + 6\text{H}_2\text{O} + \text{ATP}
\]

Glucose + Oxygen \rightarrow Carbon Dioxide + Water + Energy

G. Endoplasmic Reticulum -- found with or without ribosomes on its surface, this organelle becomes the road system within a cell
   1. Rough ER -- contains ribosomes; is the site of protein synthesis
   2. Smooth ER -- has no ribosomes; synthesizes fats and steroids

H. Golgi Apparatus -- this organelle, looking like a stack of flattened sacs, is the packing and shipping center of the cell; works by receiving all proteins produced by the ER and aids in transporting out of the cell
I. Lysosomes -- organelles likened to an internal waste-management system maintaining cellular health by ingesting and destroying invading organisms

J. Accessory structures
   1. Flagella -- structure used to propel entire cell
   2. Cilia -- hair-like structure used to propel objects from the surface of certain specialized cells such as in the bronchi or in the fallopian tubes
   3. Diseases of Accessory structures
      a. Tay-Sachs: Caused by lysosomal defect where there is an enzyme deficiency rendering the lysosome unable to digest and toxins accumulate especially in the lysosomes of neurons resulting in mental retardation and death
      b. Cigarettes and paralyzed cilia -- a side-effect of smoking; lungs are left unable to clear particles

III. Cellular Reproduction
   A. Cell Cycle- the total life of a eukaryotic or normal cell comprised of two main stages:
      1. Interphase- period or no cellular duplication
      2. Mitosis -- period of cellular division through asexual reproduction resulting with 46 chromosomes or 23 pairs of chromosomes containing all the genetic blue print needed to duplicate an identical daughter cell through four stages:
         a. Prophase (pro- before) -- nucleus disappears and spindle begins to gather all chromosomal material
         b. Metaphase (meta- between) -- chromosomes move to center
         c. Anaphase (ana- apart) -- chromosomes begin to move apart
         d. Telophase (telo- end or across) – chromosomes move to far end, spindle disappears, and nuclear membrane reappears
   B. Meiosis -- the process of reproduction of gametes or sex cells containing one half of the chromosomes from each respective parent
   C. Diseases of Cellular Reproduction
      1. Cancer or Neoplasms -- wild, uncontrolled mitotic formations leading to too many cells being formed into weird benign or malignant masses
      2. Benign tumors -- the proliferation of slow-growing cells kept within a confined space and not affecting surrounding tissues; they are not usually life-threatening
      3. Malignant tumors -- are cancerous tumors (cancer or crab-like) invading surrounding tissues or spreading through the lymphatic
system to distant parts of the body through metastasis

**Activity**

I. Complete the Introduction to Cytology Key Term worksheet  
II. Complete the Cells Laboratory Investigation  
III. Complete the Differentiating Cells Laboratory Investigation  
IV. Complete the Cell Storybook Project  
V. Complete the Trash Cell Project  

**Assessment**

Laboratory Investigation Rubric  
Introduction to Cytology Exam

**Materials**

Internet access  
microscope  
water  
slides  
coverslips  
cotton swabs  
iodine solution  
gloves  
laboratory coat or apron  
goggles  
biohazard containers  
surface disinfectant  
paper towels  
Prepared histology slides: hyperplasia, metaplasia, dysplasia and anaplasia  
Prepared histology slides of normal tissues and organs. (Note: these slides should correspond to the abnormal slides.)  
Prepared cytology slides: various structures showing cancerous tissues. (Provide at least two -- one benign and one malignant.)

**Accommodations for Learning Differences**

For reinforcement the student will draw a picture of a cell. See draw the cell activity.

For enrichment, the student will interview a cytologist or pathologist and report on their top five pathology cases and create a poster with examples of the diseased cells including a brief summary.

**National Health Science Cluster Standards**

National Health Science Cluster Standards  
*HLC01.01 Academic Foundations*  
Health care workers will know the academic subject matter required (in
their area. They will use this knowledge as needed in their role.

**HLC1O.01 Technical Skills**
Health Care Workers will apply technical skills required for all career specialties. They will demonstrate skills and knowledge as appropriate.

**TEKS**
130.206 (c)(1)(A) demonstrate safe practices during laboratory and field investigations;
130.206 (c)(2)(A) know the definition of science and understand that it has limitations, as specified in subsection (b)(2) of this section;
130.206 (c)(2)(B) know that hypotheses are tentative and testable statements that must be capable of being supported, or not supported, by observational evidence. Hypotheses of durable explanatory power which have been tested over a wide variety of conditions are incorporated into theories;
130.206 (c)(2)(C) know scientific theories are based on natural and physical phenomena and are capable of being tested by multiple independent researchers. Unlike hypotheses, scientific theories are well-established and highly-reliable explanations, but they may be subject to change as new areas of science and new technologies are developed;
130.206 (c)(2)(D) distinguish between scientific hypotheses and scientific theories;
130.206 (c)(2)(E) plan and implement descriptive, comparative, and experimental investigations, including asking questions, formulating testable hypotheses, and selecting equipment and technology;
130.206 (c)(2)(F) collect and organize qualitative and quantitative data and make measurements with accuracy and precision using tools such as calculators, spreadsheet software, data-collecting probes, computers, standard laboratory glassware, microscopes, various prepared slides, stereoscopes, metric rulers, electronic balances, hand lenses, Celsius thermometers, hot plates, lab notebooks or journals, timing devices, Petri dishes, lab incubators, dissection equipment, meter sticks, and models, diagrams, or samples of biological specimens or structures;
130.206 (c)(3)(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking by the student;
130.206 (c)(4)(C) analyze the effects of energy deficiencies in mal-absorption disorders such as diabetes, hypothyroidism, and Crohn’s

Texas College and Career Readiness Standards
*English Language Arts*
II. B. Understand new vocabulary and concepts and use them accurately in reading writing and speaking.
III. B. Develop effective speaking styles for both group and one on one
situations.
IV. A. Apply listening skills as an individual and as a member of a group in a variety of settings.
IV. B. 2. Listen actively and effectively in one-on-one communication situations.

Science
1.E.1. Use several modes of expression to describe or characterize natural patterns and phenomena. These modes of expression include narrative, numerical, graphical, pictorial, symbolic, and kinesthetic.
1.E.2. Use essential vocabulary of the discipline being studied.
3.A.1. Use correct applications of writing practices in scientific communication.
### Introduction to Cytology Terminology

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
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<tbody>
<tr>
<td>Benign</td>
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<td>Capsid</td>
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<td>Chromatin</td>
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<td>Centrioles</td>
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<td>Centrosomes</td>
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<td>Cilia</td>
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<td>Cytoplasm</td>
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<td>Deoxyribonucleic acid</td>
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<td>Diabetes Mellitus</td>
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<td>Endocytosis</td>
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<td>Endoplasmic reticulum</td>
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<td>Exocytosis</td>
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<td>Flagella</td>
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<td>Fungi</td>
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<td>Golgi apparatus</td>
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<td>Hypercholesterolemia</td>
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<tr>
<td>Term</td>
<td>Definition</td>
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<td>Lysosomes</td>
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<td>Malignant</td>
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<td>Metastasis</td>
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<td>Mitochondria</td>
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<td>Mycelia</td>
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<td>Organelles</td>
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<td>Organism</td>
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<td>Osmosis</td>
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<td>Phagocytosis</td>
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<td>Phenylketonuria</td>
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<td>Pinocytosis</td>
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<td>Protozoa</td>
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<tr>
<td>Ribonucleic acid</td>
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<td>Ribosomes</td>
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<td>Vesicle</td>
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<tr>
<td><strong>KEY- Introduction to Cytology Terminology</strong></td>
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<td>---------------------------------------------</td>
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<tr>
<td><strong>Benign</strong></td>
<td>Not progressive; usually encapsulated with no changes in surrounding tissue</td>
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<tr>
<td><strong>Capsid</strong></td>
<td>The protein coverage around virus particle</td>
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<tr>
<td><strong>Chromatin</strong></td>
<td>Unraveled, loose genetic material found in cell nucleus</td>
</tr>
<tr>
<td><strong>Centrioles</strong></td>
<td>Organelle that prepares for cell morphing preceding mitosis</td>
</tr>
<tr>
<td><strong>Centrosomes</strong></td>
<td>Region in cytoplasm containing centrioles where spindling occurs prior to mitosis</td>
</tr>
<tr>
<td><strong>Cilia</strong></td>
<td>Hair-like structures that rhythmically undulate to propel particles</td>
</tr>
<tr>
<td><strong>Cytoplasm</strong></td>
<td>Formative material within the cell that suspends all organelles</td>
</tr>
<tr>
<td><strong>Deoxyribonucleic acid</strong></td>
<td>Sequenced pairs of nucleotides forming double-helix that when segmented will make up a gene</td>
</tr>
<tr>
<td><strong>Diabetes Mellitus</strong></td>
<td>A condition resulting from insufficient insulin production causing a high build-up of blood glucose</td>
</tr>
<tr>
<td><strong>Endocytosis</strong></td>
<td>Process of cell ingestion</td>
</tr>
<tr>
<td><strong>Endoplasmic reticulum</strong></td>
<td>An organelle with a network of channels that is the site of protein, fat and glycogen production</td>
</tr>
<tr>
<td><strong>Exocytosis</strong></td>
<td>Process of transporting products outside of the cell</td>
</tr>
<tr>
<td><strong>Flagella</strong></td>
<td>A hair-like structure used for motility</td>
</tr>
<tr>
<td><strong>Fungi</strong></td>
<td>A plant-like organism including yeasts and molds that thrive on dead organic matter</td>
</tr>
<tr>
<td><strong>Golgi apparatus</strong></td>
<td>The packaging center for the cell used for the process of transportation</td>
</tr>
<tr>
<td><strong>Hypercholesterolemia</strong></td>
<td>A condition resulting with an increase of cholesterol in the blood</td>
</tr>
<tr>
<td><strong>Lysosomes</strong></td>
<td>An organelle with digestive enzymes that protects the cell from invasion</td>
</tr>
<tr>
<td><strong>Malignant</strong></td>
<td>Cancerous; a mutation in cells and tissue aggressively imposing on surrounding structures</td>
</tr>
<tr>
<td><strong>Metastasis</strong></td>
<td>The process by which cancerous cells travel through lymphatic system to invade distant structures</td>
</tr>
<tr>
<td><strong>Mitochondria</strong></td>
<td>The organelle responsible for cellular respiration</td>
</tr>
<tr>
<td><strong>Neoplasm</strong></td>
<td>New formative material causing either a benign or malignant change in tissue or organ</td>
</tr>
<tr>
<td><strong>Organelles</strong></td>
<td>Small cellular structures with specialized functions akin to miniature body systems</td>
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<td>----------------</td>
<td>----------------------------------------------------------------------------------</td>
</tr>
<tr>
<td><strong>Organism</strong></td>
<td>An individual living thing</td>
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<tr>
<td><strong>Osmosis</strong></td>
<td>The movement of water or solvent across a semi-permeable membrane to create a balanced concentration</td>
</tr>
<tr>
<td><strong>Phagocytosis</strong></td>
<td>An example of endocytosis resulting in ingestion of solid particles into the cell; cell eating</td>
</tr>
<tr>
<td><strong>Phenylketonuria</strong></td>
<td>PKU; an inherited disease causing brain injury and death when phenylketones build-up in the body</td>
</tr>
<tr>
<td><strong>Pinocytosis</strong></td>
<td>An example of endocytosis resulting in ingestion of liquid particles into the cell; cell drinking</td>
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<tr>
<td><strong>Protozoa</strong></td>
<td>Unicellular organisms such as protozoa that thrive on decaying matter</td>
</tr>
<tr>
<td><strong>Ribonucleic acid</strong></td>
<td>Molecule contained in ribosomes and necessary for making proteins</td>
</tr>
<tr>
<td><strong>Ribosomes</strong></td>
<td>Organelles made of RNA and protein material found within the cytoplasm and on the surface of endoplasmic reticulum and is the main site of protein synthesis</td>
</tr>
<tr>
<td><strong>Vesicle</strong></td>
<td>A membrane-bound storage sac with a cell</td>
</tr>
</tbody>
</table>
Cells Laboratory Investigation

Purpose
In this laboratory investigation, the student will observe cells and differentiate between normal and neoplastic tissues.

Background Information

Materials
- microscope
- water
- slides
- coverslips
- cotton swabs
- iodine solution
- gloves
- laboratory coat or apron
- goggles
- biohazard containers
- surface disinfectant
- paper towels

Procedure
1. Wash hands and put on gloves and goggles.
2. Assemble equipment and materials.
3. Prepare work area.
5. Stir end of cotton swab in drop of water on a slide.
6. Add a drop of iodine solution to color cells.
7. Place the coverslip at a 45-degree angle on the edge of the water/saliva mix. Allow the liquid to spread down the edge of the coverslip. Once it has spread, carefully lower the coverslip over the liquid.
8. Look at slide under microscope to observe skin cells.
9. Clean work area with surface disinfectant. Remove goggles and gloves and wash hands.
Data
Draw a picture of your cheek cell. Label the cell membrane, cytoplasm, and nucleus.

Conclusion:
1. List the three parts of the Cell Theory in your own words.

2. Write a brief description of each of the following:
   a. Organelle
   b. Cell membrane
   c. Cell wall
   d. Nucleus
   e. Eukaryote

3. Why is it necessary to use a stain in this lab exercise?
Differentiating Cells Laboratory Investigation

Purpose
In this laboratory investigation, the student will observe cells and differentiate between normal and neoplastic tissues.

Background Information

Materials
Microscope
Prepared histology slides: hyperplasia, metaplasia, dysplasia and anaplasia
Prepared histology slides of normal tissues and organs. (Note: these slides should correspond to the abnormal slides.)
Prepared cytology slides: various structures showing cancerous tissues.(Provide at least two – one benign and one malignant)
Gloves
Laboratory coat or apron
Goggles
Biohazard containers
Surface disinfectant
Paper towels

Procedure
1. Wash hands and put on gloves and goggles.
2. Assemble equipment and materials.
3. Prepare work area.
4. View the normal and abnormal slides.
5. Record data.
6. Clean work area with surface disinfectant. Remove goggles and gloves and wash hands.
Neoplastic

Type of Specimen:

Type of Specimen:

Type of Specimen:
Conclusion:
1. Compare and contrast the normal tissue from the non-neoplastic tissue slides.

2. Compare and contrast the normal tissue from the neoplastic tissues.

3. Explain what differentiates the neoplastic tissue from the non-neoplastic tissue. Why is the neoplastic tissue considered cancerous?
# Laboratory Investigation Rubric

**Student:** __________________________

**Course:** __________________________

**Date:** __________________________

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<tr>
<td>Problem is appropriately identified</td>
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<td>Problem is precise, clear, and relevant</td>
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<td>Association between the problem and the predicted results is direct and relevant</td>
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<td>All variables are clearly operationalized</td>
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<td>Student demonstrates comprehension of the use of scientific concepts and vocabulary</td>
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<td>All significant data is measured.</td>
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<td>Data is recorded effectively and efficiently</td>
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<tr>
<td>Data table is well-designed to the requirements of the task</td>
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<tr>
<td>All graph forms are appropriate</td>
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<td>All data is accurately plotted</td>
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<td>Graph is visually compelling; highlights conclusions of the study</td>
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<td>Conclusion relates directly to the hypothesis</td>
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<td>Conclusion has relevancy in the resolution of the original problem</td>
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<td>Conclusion relates the study to general interest</td>
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The Cell Storybook Project

Objective:
Students will work in pairs or alone to neatly create a colored illustrated children’s storybook about all the parts of a cell and their function. They will next read it aloud to an audience for an evaluation. Project Begins on: _________________; Storybook due on: ______________

Storybook Project Rubric

<table>
<thead>
<tr>
<th>Scoring Criteria</th>
<th>Points Worth</th>
<th>Points Earned</th>
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<tbody>
<tr>
<td>Creativity: Appropriate for children and fun to read</td>
<td>0-15 points</td>
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<tr>
<td>Parts Labeled / Function Given:</td>
<td>0-120 points</td>
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<tr>
<td>Cell Parts</td>
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<tr>
<td>a. Nucleus</td>
<td>(✓) Labeled</td>
<td>(✓) Function Given</td>
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<td>b. Nucleolus</td>
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<tr>
<td>c. Mitochondria</td>
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<td>d. Centrioles</td>
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<td>e. Golgi Apparatus</td>
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<td>f. Rough Endoplasmal Reticulum</td>
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<td>g. Smooth Endoplasmal Reticulum</td>
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<td>h. Lysosomes</td>
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<tr>
<td>i. Pinocytic Vesicles</td>
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<td>j. Chromatin</td>
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<tr>
<td>k. Cytoplasm</td>
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<tr>
<td>l. Cell Membrane</td>
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<tr>
<td>Illustrations: Sketch and color the words and pictures to emphasize the functions of the parts</td>
<td>0 -100 points</td>
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<td>Follows Instructions:</td>
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<td>• project submitted on time</td>
<td>0-15 points</td>
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<td>• story appropriate for children</td>
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<td>• Neat</td>
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<tr>
<td>TOTAL POINTS:</td>
<td>Up to 250 points</td>
<td></td>
</tr>
</tbody>
</table>

FINAL GRADE: (earned / max) x 100
# Trash Cell Project

## Objective:
Students will build a 3-D model of an animal cell using recycled or “trash” materials only. The items in your model should look like the structure it depicts and be as anatomically correct as possible. For example, the Golgi Apparatus has folded membranes, so it should look folded. Each structure must be neatly labeled. Your project can be no larger than 2x2x2. NO Food items or other material that will mold, rot, or smell may be used.

**Project Begins On:** ______________  **Cell Model Due On:** ______________

It must include the following structures:

<table>
<thead>
<tr>
<th>A. Cell Parts</th>
<th>Labeled 0-10 points</th>
<th>B. Presentation 0-20 points</th>
<th>C. Creativity 0-20 points</th>
<th>Total Max (0-160)</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Nucleus</td>
<td>______</td>
<td>(0-10 pts) Alphabet Label with no Key provided, &gt; 3 days late</td>
<td>(0-10 pts) Cluttered cell, unable to clearly distinguish organelles</td>
<td></td>
</tr>
<tr>
<td>b. Nucleolus</td>
<td>______</td>
<td>(11-15 pts) Key handwritten, labels sloppy, 1-2 days late</td>
<td>(11-15 pts) Creativity, slightly cluttered / small cell, visualize organelles</td>
<td></td>
</tr>
<tr>
<td>c. Mitochondria</td>
<td>______</td>
<td>(16-20 pts) Typed Key, neat print, clearly labeled, turned in on time</td>
<td>(16-20 pts) Neat creativity, all recycled materials, uncluttered, neat and clearly designed</td>
<td></td>
</tr>
<tr>
<td>d. Centrioles</td>
<td>______</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>e. Golgi Apparatus</td>
<td>______</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>f. Rough Endoplasmic Reticulum</td>
<td>______</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>g. Smooth Endoplasmic Reticulum</td>
<td>______</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>h. Lysosomes</td>
<td>______</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>i. Pinocytic Vesicles</td>
<td>______</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>j. Chromatin</td>
<td>______</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>k. Cytoplasm</td>
<td>______</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>l. Cell Membrane</td>
<td>______</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**A. Total (0-120 points) ______**  **B. Total: ______**  **C. Total ______**

**Comments:** ____________________________

**FINAL GRADE** (earned / 160 ) x 100

*Early Bird Points +10 = _____*
Draw a Cell

NAME: ____________________________
DATE: ____________________________

Draw a cell with all of the following structures; include the function of each.

- Nucleus
- Nucleolus
- Mitochondria
- Rough Endoplasmic Reticulum
- Centrioles
- Golgi Apparatus
- Lysosomes
- Smooth Endoplasmic Reticulum
- Pinocytic Vesicles
- Chromatin
- Cytoplasm
- Cell membrane
INTRODUCTION TO CELLS QUIZ

NAME: ____________________________
DATE: ____________________________

Instructions: Choose the best answer choice and place answer in the space provided.

1. _____ The rough endoplasmic reticulum is the primary site for:
   a. chlorophyll formation   c. photosynthesis
   b. protein synthesis    d. osmosis

2. _____ In a cell, proteins are broken down into:
   a. fatty acids     c. nucleotides
   b. glucose     d. amino acids

3. _____ This organelle contains a digestive enzyme that acts to clean the cell.
   a. vacuoles      c. lysosomes
   b. cytoplasm     d. mitochondria

4. _____ At the site of cellular respiration, glucose converts to:
   a. O₂ + H₂O + ATP     c. C₆H₁₂O₆ + O₂
   b. CO₂ + H₂O + ATP    d. NaOH + H₂O + ATP

5. _____ These organelles become paralyzed and make it difficult to clear particles.
   a. Flagella     c. cilia
   b. Goblet cells     d. mucous

6. _____ The movement of water due to the concentration of solutes happens primarily in this location:
   a. Cell wall     c. mitochondria
   b. Cell membrane     d. none of the above

7. _____ Mitosis and meiosis respectively will generate the following:
   a. 46 pairs / 23 pairs of chromosomes c. 46 pair / 23 single chromosomes
   b. 23 pairs / 23 pairs of chromosomes d. 23 pair / 23 single chromosomes

8. _____ This human “blueprint” that coils during mitosis contains all your DNA material found within the nucleus Is called:
   a. Chlorophyll     c. nucleus
   b. Chrome     d. chromatin

9. _____ The physical movement of particles out of the cell such as secretion of enzymes from salivary gland cells is:
   a. Exocytosis     c. endocytosis
   b. Phagocytosis     d. pinocytosis
10. _____ Found singly in cytoplasm or on endoplasmic reticulum and is the site of cell repair and reproduction.
   a. Mitochondria
   b. Ribosomes
   c. rough ER
   d. smooth ER

11. _____ The reason for polyuria and polydipsia (chronic thirst) in diabetics is due to lack of insulin resulting in a _________ environment that draws water from the cells.
   a. Isotonic
   b. Hypotonic
   c. hypertonic
   d. hypnotic

12. _____ Place in the proper order:
   a. Organelle, cell, molecule, atom
   b. Cell, molecule, atom, organelle
   c. atom, molecule, organelle, cell
   d. molecule, atom, organelle, cell

13. _____ The cell activity that is of biggest concern when creating therapeutic drugs for cancer patients is:
   a. Osmosis
   b. Meiosis
   c. lysosomal activity
   d. mitosis

14. _____ Intercostal muscles as opposed to a visceral muscle would require more _______ due to chronic use and increase activity.
   a. Mitochondria
   b. Cytoplasm
   c. nuclei
   d. lysosomes

15. _____ Liver cells compared to salivary cells would require more ______________ due to increase use and activity requirements.
   a. Mitochondria
   b. Cytoplasm
   c. nuclei
   d. lysosomes

Instructions: Place the following types of cell activities in the correct category of:

   a. ACTIVE TRANSPORT     OR     b. PASSIVE TRANSPORT

16. _______________________osmosis
17. _______________________phagocytosis
18. _______________________filtration
19. _______________________diffusion
20. _______________________facilitated diffusion
21. _______________________exocytosis
INTRODUCTION TO CELLS QUIZ- KEY

Instructions: Choose the best answer choice and place answer on the space provided.

1. B
2. B
3. D
4. C
5. B
6. C
7. B
8. D
9. D
10. A
11. B
12. C
13. D
14. A
15. C

Instructions: Place the following types of cell activities in the correct category of:

a. ACTIVE TRANSPORT  OR  b. PASSIVE TRANSPORT

16. PASSIVE TRANSPORT  19. PASSIVE TRANSPORT
17. ACTIVE TRANSPORT  20. PASSIVE TRANSPORT
18. PASSIVE TRANSPORT  21. ACTIVE TRANSPORT