

SCIENCE: BIOLOGY**UNIT #7: CELL STRUCTURE AND FUNCTION (4 weeks)**

SYNOPSIS: Students will consider the scientific evidence that scientists used to understand that the cell is the smallest unit that is classified as a living thing and it is the basic structural and functional unit of all known living organisms. Students will consider the intricate network of organelles within cells that all have unique functions which allow the cell to function properly and maintain its living condition. Students will explain what would happen if a specific organelle malfunctioned and how it would impact the entire cell.

Enablers: Cell Theory

STANDARDS**IV. CELLS****A. Cell structure and function**

[Note: This topic focuses on the cell as a system itself (single-celled organism); as a part of larger systems (multicellular organism), and sometimes as part of a multicellular organism. But they are always as part of an ecosystem.]

1. The living conditions is dependent on the structure, function and interrelatedness of cell parts. A living cell is composed of a small number of elements - - mainly carbon, hydrogen, nitrogen, oxygen, phosphorous and sulfur.
 - a. because of its small size and four available bonding electrons, carbon can join to other carbon atoms in chains and rings to form large and complex molecules (macromolecules; organic building blocks / amino acids)
 - b. the essential functions of cells involve chemical reactions that involve water and carbohydrates, proteins, lipids and nucleic acids
 - c. cell functions are regulated; complex interactions among the different kinds of molecules in the cell cause distinct cycles of activities - - such as growth and division
 - d. most cells function within a narrow range of temperature and pH; at very low temperatures, reactions are slow ; high temperatures and/or extremes of pH can irreversibly change the structure of most protein molecules; even small changes in pH can alter how molecules interact.
 - e. examples of homeostasis at the cellular level to maintain equilibrium are diffusion, osmosis, and active transport
 - f. cellular organelles include cytoskeleton, Golgi complex, and endoplasmic reticulum
 - g. every cell is covered by a membrane that controls what can enter and leave the cell
 - h. within the cell are specialized parts for the transport of materials, energy transformation, protein building, wasted disposal, information feedback and movement
 - i. most cells in multicellular organisms perform some specific functions that others do not
2. Scientists believe that prokaryotic cells (in the form of bacteria) were the first life forms on earth
 - a. from about 4 billion years ago to about 2 billion years ago, only simple, single-celled microorganisms (Prokaryotic cells) are found in the fossil record
 - b. once cells with nuclei developed about a billion years ago, increasingly complex multicellular (Eukaryotic cells)
 - c. in all but quite primitive cells, a complex network of proteins provides organization and shape

LITERACY STANDARDS

RST.2 Determine the central ideas or conclusions of a text; trace the text's explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text.

WHST.10 Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences. [Compare/contrast prokaryote vs. eukaryote]

MOTIVATION	TEACHER NOTES
<ol style="list-style-type: none"> 1. Teacher reviews how the scientific method is a way to ask and answer scientific questions by making observations and doing experiments; students complete activities using scientific method. 2. Teacher explains that for centuries, people believed the idea that a variety of organisms could arise spontaneously out of non-living material (e.g., flies from rotting meat, snakes from horsehair in a trough, sheep drop out of sky); students consider the logic behind these notions. Teacher relates background about spontaneous generation and the work of early scientists to answer the question about the origin of living things; teacher reminds students of the limitations of equipment they had to use at that time. Students read about Redi's experiment and consider what he was thinking to formulate his conclusions; class discusses the rationale for spontaneous generation and how the idea could be proven right or wrong. 3. Students set personal and academic goals. 4. Teacher previews for students what the end of the unit authentic assessment will be and what students will be expected to do. 	<p>#1. PPT Activities Using Scientific Method</p> <p>#2. Redi's experiment attached on pages 5-6</p>

TEACHING-LEARNING	TEACHER NOTES																														
<p>Vocabulary</p> <table border="0"> <tr> <td>nucleolus</td> <td>lysosomes</td> <td>cytoskeleton</td> <td>facilitated diffusion</td> <td>homeostasis</td> </tr> <tr> <td>flagella</td> <td>vacuoles</td> <td>tonicity</td> <td>active transport</td> <td>macromolecules</td> </tr> <tr> <td>nucleus</td> <td>mitochondria</td> <td>nucleolus</td> <td>cytolysis</td> <td>amino acids</td> </tr> <tr> <td>ribosomes</td> <td>cell membrane</td> <td>hypotonic</td> <td>plasmolysis</td> <td>mono-,di-,polysaccharides</td> </tr> <tr> <td>cell walls</td> <td>endoplasmic reticulum</td> <td>isotonic</td> <td>pinocytosis</td> <td>fatty acids/glycerol</td> </tr> <tr> <td>Golgi complex</td> <td>chloroplast/chlorophyll</td> <td>hypertonic</td> <td>phagocytosis</td> <td>nucleic acids</td> </tr> </table> <ol style="list-style-type: none"> 1. Teacher provides information (10 min. PPT) on the contributions made by scientists which led to the development of the Cell Theory (text page 170); teacher asks students to consider the possible limitations of the equipment they used and the length of time it took to reach the final conclusions about cells. Students discuss how these observations and conclusions gradually led to the basic theory about all cells. Teacher introduces early forms of life (prokaryotes) that exist today as simple, single-celled organisms (bacteria) and compares them to the more complex, single-celled (protists) and multicellular eukaryotes (fungi, plants, animals); students record notes about the traits of each type on column chart. (IV A 2 a,b) 2. Teacher introduces lab demo (that is conducted for several days) or internet animation to explain Pasteur's experiment which refutes idea of spontaneous generation. Students predict what will happen in the flasks before observing results and explain their reasoning. (IV A 2a,b,c; WHST 10) http://bcs.whfreeman.com/thelifewire/content/chp03/0302003.html 3. Teacher shows photos taken from an electron microscope (from internet) and tells them what they are viewing; students discuss the benefits and drawbacks of increased magnification. Teacher shows students a compound light microscope and asks what kinds of things can/cannot be seen with it; the attributes of objects that can be seen and the limitations of microscopic viewing (e.g., viewing area; direction image moves compared to object; high power, low power; object's size, thickness, being opaque, movement). Teacher discusses the function of the parts and how it should be handled and used properly; students label drawing of microscope. www.ekcsk12.org/faculty/jbuckley/lelab/microscopeuselab.htm 	nucleolus	lysosomes	cytoskeleton	facilitated diffusion	homeostasis	flagella	vacuoles	tonicity	active transport	macromolecules	nucleus	mitochondria	nucleolus	cytolysis	amino acids	ribosomes	cell membrane	hypotonic	plasmolysis	mono-,di-,polysaccharides	cell walls	endoplasmic reticulum	isotonic	pinocytosis	fatty acids/glycerol	Golgi complex	chloroplast/chlorophyll	hypertonic	phagocytosis	nucleic acids	<p>#1.PPT- Cell Theory Comparison of Prokaryotic and Eukaryotic Cells (may be completed later in unit when cell structures have been studied) attached on page 7</p> <p>#2. PPT - Where Do Bacteria Come From? demo</p> <p>Microscope Lab Activity attached on pages 8-12</p>
nucleolus	lysosomes	cytoskeleton	facilitated diffusion	homeostasis																											
flagella	vacuoles	tonicity	active transport	macromolecules																											
nucleus	mitochondria	nucleolus	cytolysis	amino acids																											
ribosomes	cell membrane	hypotonic	plasmolysis	mono-,di-,polysaccharides																											
cell walls	endoplasmic reticulum	isotonic	pinocytosis	fatty acids/glycerol																											
Golgi complex	chloroplast/chlorophyll	hypertonic	phagocytosis	nucleic acids																											

TEACHING-LEARNING	TEACHER NOTES
<p>4. Students work in small groups to complete Introduction to the Microscope Lab Activity which includes preparing and viewing a temporary wet-mount of letter “e” placed right-side up as you would read it by comparing: (a) how it looks in normal view compared to image produced with low power 10X objective in terms of the position, size and qualities; students draw/sketch what is seen. Students move slide to the right, record the direction the images move; they change the objective to high power 40X and keep the slide in same position; students sketch what is visible in the viewing area. Students determine total magnification on high and low power and answer conclusion questions.</p> <p>5. Teacher introduces Cheek Cell Lab PPT.... as motivation for study of cells; students prepare a temporary wet-mount slide of his/her cheek cells; using staining procedure with Lugol's (iodine) solution or methylene blue. Students examine cell structure with scanning, low and high power; they sketch each view. (IV A 1 f,g)</p> <p>6. Students prepare onion epidermis slide and compare what they see with plant and animal cells. Students should notice conformity in plant tissue due to cell walls and a more random shape and arrangement in animal cells. (IV A 1f,g)</p> <p>7. Teacher shows Organelles PPT and introduces cell structure including organelles (listed above in Vocabulary), their structure and function. Students use comparison chart for plant and animal cells. (IV A 1f,g)</p> <p>8. Teacher uses “Cell City Analogy” (or some other comparative structure) to introduce cell structure - - parts of a city – parts of a cell; students complete the analogy for a city and then create another analogy to show cell parts. Refer to Discovery Education (United Streaming) (IV A 1f,g,h,i)</p> <p>9. Teacher introduces movement of materials across the cell membrane (using a PPT; flash graphic from Teachersdomain.org) and osmosis and diffusion as the processes of movement. Teacher demonstrates what determines the concentration of a solution using beakers of water with varying amount of sugar/salt; students observe that the salt dissolves until it reaches its saturation. Students taste different concentrations of Kool-Aid with low, medium and high amounts of sugar added and relate the amount of the solute added to the effect that it has. Teacher asks students to determine how to make it more/less concentrated; students use terms: concentrated, dilute, dissolve, saturated, solute, and solvent (text pg. 183). (IV A 1e,g)</p> <p>10. Teacher explains that the direction of molecules into or out of cells is based on the difference in concentrations of molecules (tonicity) on both sides of the cell membrane; students take notes and sketch drawings of cells in three different solutions: hypotonic, hypertonic, isotonic, and use arrows to indicate the direction the water molecules move (i.e., from outside to inside the cell, from inside to outside, moves equal in both directions with no net movement). Students explain how the size and/or shape of the cells changes due to the gain or loss of water molecules and label sketches of resulting cells as examples of cytolysis, plasmolysis, no change. Students discuss real-life examples of these processes. Teacher explains how the structures of plant cells (cell wall) and animal cells (contractile vacuoles) prevent destruction of the cells as movement of water can put pressure on the cell membrane. (IV A 1e,g)</p> <p>11. Students conduct Elodea Lab to observe how the cell membrane can be selectively permeable by allowing some substances to diffuse into or out of the cell and at the same time</p>	<p>#5. Cheek Cell Lab attached on pages 13-14 Cheek Cell PPT</p> <p>#6. Onion Cell Lab attached on pages 15-16</p> <p>#7. Organelles PPT #7. Comparing Plant and Animal Cells chart attached on pages 17-18</p> <p>#8. Cell City Analogy Copy and key attached on pages 19-20</p> <p>#9. Diffusion and Osmosis PPT</p> <p>#10. Video – Active Transport and Facilitated Diffusion</p>

TEACHING-LEARNING	TEACHER NOTES
<p>restricting others from passing through it. (IV A 1e,g)</p> <p>12. Students read text pages 187-189 about facilitated diffusion and active transport; teacher uses video to show how these processes are exceptions to regular diffusion and osmosis against the concentration gradient (i.e., sodium pumps, pinocytosis, and phagocytosis); students answer questions on observation sheet as teacher shows processes. Teacher leads students to discover “why” this does happen. (IV A 1e,g)</p> <p>13. Teacher shows PPT to introduce cell chemistry in terms of 4 basic elements, purpose/function of macromolecules (i.e., carbohydrates, fats, proteins, nucleic acids); students build macromolecules (using Legos, marshmallows, gumdrops) and compare the structures of them to each other. (IV A 1a,b,c)</p> <p>14. Students read text pages 42-43 to review acidic and basic properties; teacher explains that cells function within a narrow range of temperature and pH; at very low temperatures, reactions are slow; high temperatures and/or extremes of pH can irreversibly change the structure of most protein molecules; even small changes in pH can alter how molecules interact. Students read article: “What in the cell is going on? – the Battle is over pH” and discuss the analogy described in terms of control of cellular processes. Students determine the central ideas or conclusions of the text; trace the depiction of the complex process and provide an accurate summary of it in terms of the effects of pH. (IV A 1d; RST.2)</p> <p>15. Teacher revisits Bacteria Lab (demo)/or uses pictures from the lab(attached); students draw conclusions about why bacteria grew, how it got there (considering everything was sterile), etc. Students complete lab report. (IV A 2a,b,c)</p>	<p>#13. PPT Biology Macromolecules</p> <p>#14. Article: “What in the Cell is Going on? - - The Battle is over pH” attached on pages 21-23</p>

TRADITIONAL ASSESSMENT	TEACHER NOTES
1. Unit Test	

TEACHER ASSESSMENT	TEACHER NOTES
1. Quizzes 2. Science Notebooks –student work on literacy standards, lab data sheets, lecture notes 3. 2pt. and 4 pt. constructed response questions 4. Lab work and activities	

AUTHENTIC ASSESSMENT	TEACHER NOTES
1. Students evaluate their goals 2. Student writes an explanation for the prompt: If a specific cell organelle malfunctions (e.g., mitochondria, ribosome, cell membrane, nucleus, chloroplast, cell wall, Golgi complex, endoplasmic reticulum) describe what happens and how homeostasis is impacted; relate the effect to other parts of the cell and use a diagram to show their thinking. (IV A 1b-h) (WHST.10)	

Redi's Experiment

Francesco Redi - One of the first to disprove spontaneous generation. An Italian doctor who proved maggots came from flies. (Italian 1668)

Spontaneous Generation

- The idea that organisms originate directly from nonliving matter.
- "life from nonlife"

abiogenesis - (a-not bio-life genesis-origin) Redi's Problem

Where do maggots come from?

Hypothesis: Maggots come from flies.

Redi put meat into three separate jars.

Jar 1 was left open

Jar 2 was covered with netting

Jar 3 was sealed from the outside



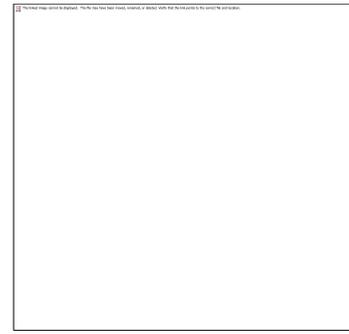
Redi's Experiment Step 1

Jar-1

Left open

Maggots developed

Flies were observed laying eggs on the meat in the open jar



Redi's Experiment Step 2

Jar-2

Covered with netting

Maggots appeared on the netting

Flies were observed laying eggs on the netting

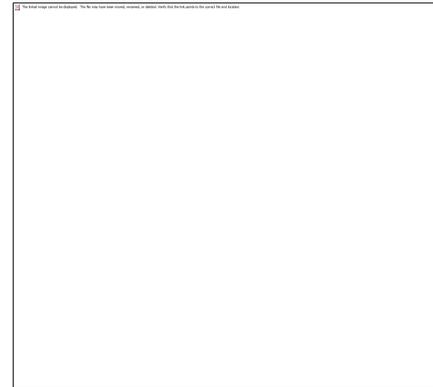


Redi's Experiment Step 3

Jar-3

Sealed

No maggots developed



Redi's Experiment Results

What did Redi's experiment show?

Was his hypothesis correct or incorrect?

Copyright ©, 1998 Tim Lynch

T-L #1 Comparison of Prokaryotic and Eukaryotic Cells

Eukaryotic and Prokaryotic Cell Structure		
Cell Structure	Prokaryotic Cell	Typical Animal Eukaryotic Cell
Cell Membrane	Yes	Yes
Cell Wall	Yes	No
Centrioles	No	Yes
Chromosomes	One long DNA strand	Many
Cilia or Flagella	Yes, simple	Yes, complex
Endoplasmic Reticulum	No	Yes (some exceptions)
Golgi Complex	No	Yes
Lysosomes	No	Common
Mitochondria	No	Yes
Nucleus	No	Yes
Peroxisomes	No	Common
Ribosomes	Yes	Yes

T-L #3 Introduction to the Microscope Lab Activity (paper copy)

5/22/2015

YCS BIOLOGY: Unit #7 – Cell Structure and Function 7

Introduction to the Microscope Lab Activity

Introduction

"Micro" refers to **tiny**, "scope" refers to **view or look** at. Microscopes are tools used to enlarge images of small objects so as they can be studied. The compound light microscope is an instrument containing **two lenses**, which magnifies, and a variety of **knobs to resolve (focus)** the picture. Because it uses more than one lens, it is sometimes called the compound microscope in addition to being referred to as being a light microscope. In this lab, we will learn about the proper use and handling of the microscope.

Instructional Objectives

- Demonstrate the proper procedures used in correctly using the compound light microscope.
- Prepare and use a wet mount.
- Determine the total magnification of the microscope.
- Explain how to properly handle the microscope.
- Describe changes in the field of view and available light when going from low to high power using the compound light microscope
- Explain why objects must be centered in the field of view before going from low to high power using the compound light microscope.
- Explain how to increase the amount of light when going from low to high power using the compound light microscope.
- Explain the proper procedure for focusing under low and high power using the compound light microscope.

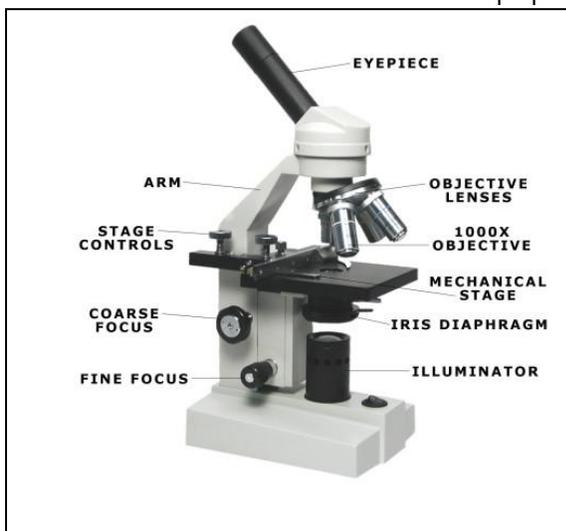
Materials

- Compound microscope
- Glass slides
- Cover slips
- Eye dropper
- Beaker of water
- The letter "e" cut from newsprint
- Scissors

Procedures

I. Microscope Handling

1. **Carry the microscope with both hands** --- one on the arm and the other under the base of the microscope.
2. One person from each group will now go over to the microscope storage area and properly **transport one microscope to your working area.**
3. The other person in the group will **pick up a pair of scissors, newsprint, a slide, and a cover slip.**
4. **Remove the dust cover** and store it properly. Plug in the scope. Do not turn it on until told to do so.



5. **Examine the microscope and give the function of each of the parts** listed on the right side of the diagram.

YCS BIOLOGY: Unit #7 – Cell Structure and Function

arm - this attaches to the base.

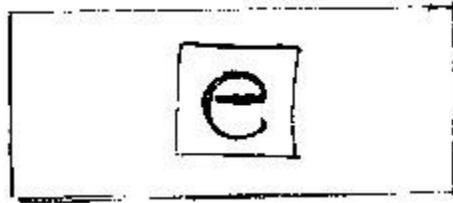
base - this supports the microscope.
coarse focus - a knob that moves the stage up and down to bring the specimen into focus.

iris diaphragm - an opening that allows light to pass through, allowing different amounts of light to reach the specimen.

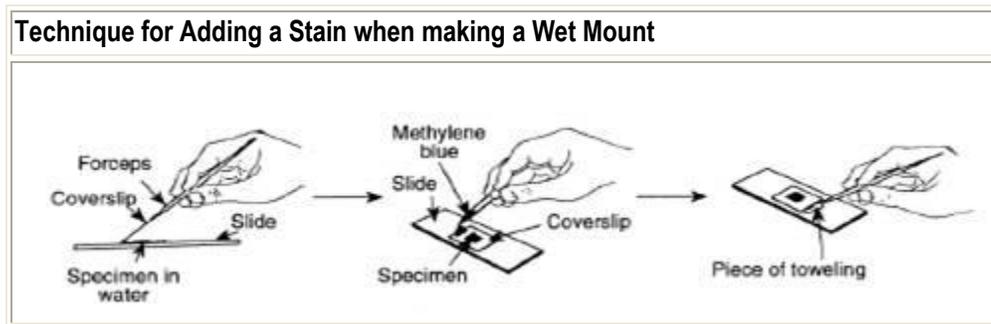
eyepiece - where you look through to see the specimen.
fine focus - a knob that moves the stage up and down to bring the specimen into focus (it is often used for high magnification).
objective lenses - used to magnify the specimen.

Part II. Preparing a wet mount of the letter "e".

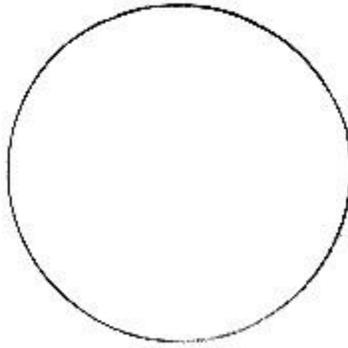
1. With your scissors cut out the letter "e" from the newspaper.
2. Place it on the **glass slide** so as to look like (e).
3. **Cover it with a clean cover slip.** See the figure below.



4. **Using your eyedropper, place a drop of water on the edge of the cover slip** where it touches the glass slide. The water should be sucked under the slide if done properly.



5. **Turn on the microscope and place the slide on the stage; making sure the "e" is facing the normal reading position** (see the figure above). Using the course focus and low power, move the body tube down until the "e" can be seen clearly. **Draw what you see** in the space below.

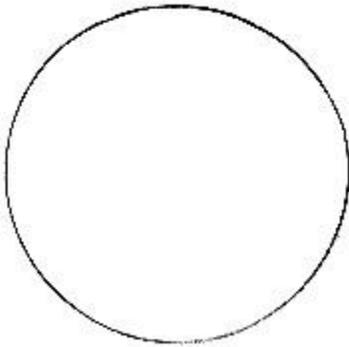


6. Describe the relationship between what you see through the eyepiece and what you see on the stage.

7. Looking through the eyepiece, move the slide to the upper right area of the stage. **What direction does the image move?**

8. Now, move it to the lower left side of the stage. **What direction does the image move?**

9. Re-center the slide and change the scope to high power. You will notice the "e" is out of focus. **Do Not** touch the coarse focus knob, instead use the fine focus to resolve the picture. Draw the image you see of the letter e (or part of it) on high power.



10. **Locate the diaphragm under the stage.** Move it and record the changes in light intensity as you do so.

III. Determining Total Magnification:

1. Locate the numbers on the eyepiece and the low power objective and fill in the blanks below.

Eyepiece magnification _____	(X)	Objective magnification _____	=	Total Magnification _____ X
--	------------	---	----------	--

2. Do the same for the high power objective.

Eyepiece magnification _____	(X)	Objective magnification _____	=	Total Magnification _____ X
--	------------	---	----------	--

3. Write out the **rule for determining total magnification of a compound microscope.**

4. **Remove the slide and clean it up.** Turn off the microscope and wind up the wire so it resembles its original position. Place the low power objective in place and lower the body tube. Cover the scope with the dust cover. Place the scope back in its original space in the cabinet.

Conclusion Questions:

1. State 2 procedures which should be used to properly handle a light microscope.

2. Explain why the light microscope is also called the compound microscope.

3. Images observed under the light microscope are reversed and inverted. Explain what this means.

4. Explain why the specimen must be centered in the field of view on low power before going to high power.

5. A microscope has a 20 X ocular (eyepiece) and two objectives of 10 X and 43 X respectively:
 - a.) Calculate the low power magnification of this microscope. Show your formula and all work.

- b.) Calculate the high power magnification of this microscope.
Show your formula and all work.
6. In three steps using complete sentences, describe how to make a proper wet mount of the letter e.
7. Describe the changes in the field of view and the amount of available light when going from low to high power using the compound microscope.
8. Explain what the microscope user may have to do to combat the problems incurred in question # 7.
9. How does the procedure for using the microscope differ under high power as opposed to low power?
10. Indicate and describe a major way the stereomicroscope differs from the compound light microscope in terms of its use.

T-L #5 Cheek Cell Lab

Name _____ Date _____ Period _____

Introduction:

Many things that are viewed using a microscope, particularly cells, can appear quite transparent under the microscope. The internal parts of the cells, the organelles, are so transparent that they are often difficult to see. Biologists have developed a number of stains that help them see the cells and their organelles by adding color to their transparent parts. While many biological stains are for advanced study only, there are some that are easy to obtain and use. Some readily available stains are: food coloring, iodine, malachite green (Ick fish cure), and methylene blue. Food coloring can be found at a grocery store, and iodine can be found at a pharmacy. The last two stains, malachite green and methylene blue can be purchased at aquarium shops. Interestingly, certain stains color certain parts of a cell. Scientists choose specific stains when they want to look at a particular part of a cell. You will be experimenting with the two of the stains listed above to see which parts of your cheek cells each one colors.

Objectives:

- Demonstrate the proper procedures used in correctly using the compound light microscope.
- Prepare and use a wet mount of living cells.
- Stain a wet mounted sample
- Identify cellular organelles in a stained tissue sample

Materials:

- | | |
|--|---------------------------------|
| · Microscope | Paper towel |
| · Eyedropper | Water |
| · 2 flat slides | Pencil |
| · 2 cover slips | Paper |
| · Toothpick | Eraser |
| · Cheek cells | Dilute bleach water in a beaker |
| · Stain (Lugol's solution or methylene blue) | |

Procedures:

1. Before you begin, decide which stain you will use for the experiment (Lugol's solution or methylene blue). After you have completed your work discard the cover slip and soak the slide in the bleach solution for 5 minutes. **RINSE & DRY YOUR OWN SLIDE BEFORE YOU LEAVE!**
2. Cells from the inside lining of your cheek are good for learning how to stain. Gently scrape the inside of your mouth with the flat side of a toothpick. This scraping will collect some of your cheek cells. (Don't worry; these cells are constantly being shed from your mouth so they will not be missed!)
3. Place the cells on a flat slide and make a wet mount using water and a cover slip as you did in the Lab 1 when you made a wet mount of the lower case "e".
4. Now repeat this procedure so that you have two wet mounts of cheek cells (one for each partner in you group).
5. Now you need to add stain to one slide. To add stain, put a drop of the stain next to the cover slip on the slide and then draw it under the cover slip by placing a piece of paper towel against the other side of the cover slip. The paper towel will soak up the water, drawing the stain under the cover slip around the cell. Drawing the stain under the cell is called "wicking."
6. Use the Scanning/Low power/ 4x objective to focus, look at the stained slide under the microscope. You probably will not see the cells at this power. **Sketch** what you see below and place the magnification next to the drawing.
7. Switch to low power. Cells should be visible, but they will be small and look like nearly clear blobs (stained cells will be easier to see). Solid dark objects are probably not cellular. **Sketch** what you see below and place the magnification next to the drawing.

8. Once you think you have located a cell, switch to a high power and refocus. (Remember; do **NOT** use the coarse adjustment knob at this point).

Sketch what you see below and place the magnification next to the drawing.

Sketch the stained cells at scanning, low and high power. Label the nucleus, cytoplasm, and cell membrane. Draw your cells to scale and include the magnification.

Scanning (____x)

Low (____x)

High (____x)

9. Now look at the unstained slide under the microscope repeating steps 6-8. Is it different?

Sketch what you see and place the magnification next to the drawing.

Sketch the unstained cells at scanning, low and high power. Label the nucleus, cytoplasm, and cell membrane. Draw your cells to scale and include the magnification.

Scanning (____x)

Low (____x)

High (____x)

10. Why were the Lugol's Solution and/or methylene blue necessary?

11. Cheek cells do not move on their own, so you will not find two organelles that function for cell movement. Name these organelles.

12. The light microscope used in this lab is not powerful enough to view other organelles in the cheek cell. What parts of the cell **were** visible? What parts of the cell **were not**?

Parts of the cheek cell that **were** visible:

Parts of the cheek cell that **were not** visible:

13. Were the cheek cells you observed eukaryotic or prokaryotic? How do you know?

T-L #6 The Onion Cell Lab

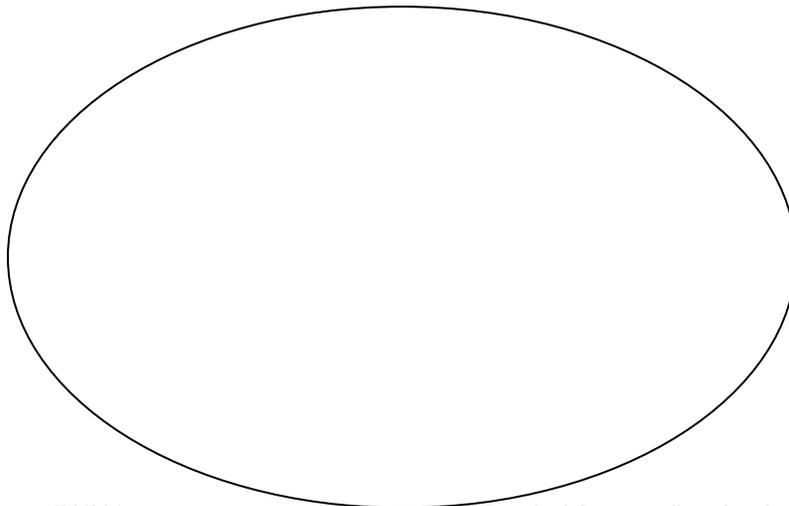
Background: Onion tissue provides excellent cells to study under the microscope. The main cell structures are easy to see when viewed with the microscope at medium power. For example, you will observe a large circular **nucleus** in each cell, which contains the genetic material for the cell. In each nucleus, are round bodies called **nucleoli**. The nucleolus is an organelle, which synthesizes small bodies called ribosomes. Ribosomes are so small you cannot see them with the light microscope. Also present in the onion cell, is a well-developed **cell wall** and a **cell membrane** just beneath it.

Purpose: To study the structure of the onion epidermal cell, with particular emphasis on the nucleus and nucleoli.

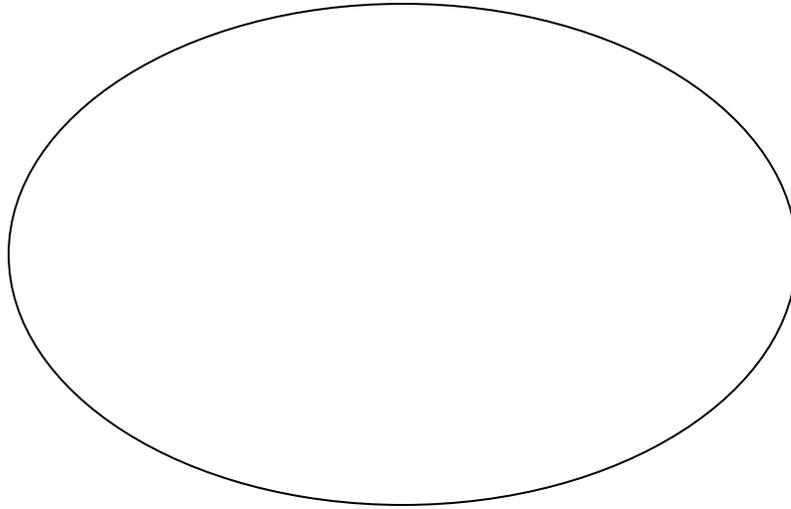
Materials: The following materials are required: onion, microscope, glass slide, cover slip, and iodine (**Note:** iodine is toxic and will stain - handle with care).

Procedure:

1. Get a glass slide and cover slip for yourself and make sure they are both thoroughly washed and dried.
2. Remove the single layer of epidermal cells from the inner (concave) side of the scale leaf (The thinner the better).
3. Place the single layer of onion cell epithelium on a glass slide. Make sure that you do not fold it over or wrinkle it.
4. Place a drop of iodine stain on your onion tissue.
5. Put the cover slip on the stained tissue and gently tap out any air bubbles.
6. Observe the cells under 4x, 10x, and 40x with the diaphragm wide open. Slowly reduce the light intensity by closing the diaphragm, and observe the image.
Which light intensity revealed the greatest cellular detail? _____
7. In the space provide below, **draw a group of 10 neighboring cells** at 10x. In one cell, label all the parts you see.



8. Switch to high power at 40x. Can you see a whole cell? If you can, **draw one cell and label it below**. If no, go back to 10x and draw one cell and label it below.



Questions:

1. What is the function of the nucleus?
2. Where is the nucleolus found and what does it produce?
3. Describe what ribosomes do in the cell?

T-L #7 Chart – Comparing Plant and Animal Cells

Plant and animal cells have several differences and similarities. For example, animal cells do not have a cell wall or chloroplasts but plant cells do. Animal cells are round and irregular in shape while plant cells have fixed, rectangular shapes.

	Animal Cell	Plant Cell
Cell wall:	Absent	Present
Shape:	Round (irregular shape)	Rectangular (fixed shape)
Vacuole:	One or more small vacuoles (much smaller than plant cells).	One, large central vacuole taking up 90% of cell volume.
Centrioles:	Present in all animal cells	Only present in lower plant forms.
Chloroplast:	Animal cells don't have chloroplasts	Plant cells have chloroplasts because they make their own food
Cytoplasm:	Present	Present
Endoplasmic Reticulum (Smooth and Rough):	Present	Present
Ribosomes:	Present	Present
Mitochondria:	Present	Present
Plastids:	Absent	Present
Golgi Apparatus:	Present	Present
Plasma Membrane:	only cell membrane	cell wall and a cell membrane
Microtubules/ Microfilaments:	Present	Present
Flagella:	May be found in some cells	May be found in some cells
Lysosomes:	Lysosomes occur in cytoplasm.	Lysosomes usually not evident.
Nucleus:	Present	Present
Cilia:	Present	It is very rare

Plant cells have chloroplast for [photosynthesis](#) whereas animal cells do not have [chloroplasts](#).

Shape

- Another difference between plant cells and animal cells is that animal cells are round whereas plant cells are rectangular.
- [Further](#), all animal cells have [centrioles](#) whereas only some lower plant forms have centrioles in their cells.

Vacuoles

Shape and size of vacuoles

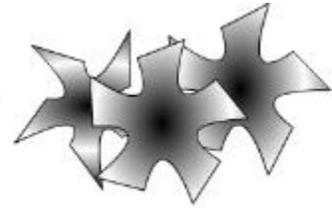
Animal cells have one or more small vacuoles whereas plant cells have one large central [vacuole](#) that can take up to 90% of cell volume.

Difference in function of vacuoles

In plant cells, the function of vacuoles is to store water and maintain turgidity of the cell. Vacuoles in animal cells store water, ions and waste.

Cell City Analogy

In a faraway city called Grant City, the main export and production product is the steel widget. Everyone in the town has something to do with steel widget making and the entire town is designed to build and export widgets. The town hall has the instructions for widget making, widgets come in all shapes and sizes and any citizen of Grant can get the instructions and begin making their own widgets. Widgets are generally produced in small shops around the city, these small shops can be built by the carpenters union (whose headquarters are in town hall).



After the widget is constructed, they are placed on special carts which can deliver the widget anywhere in the city. In order for a widget to be exported, the carts take the widget to the postal office, where the widgets are packaged and labeled for export. Sometimes widgets don't turn out right, and the "rejects" are sent to the scrap yard where they are broken down for parts or destroyed altogether. The town powers the widget shops and carts from a hydraulic dam that is in the city. The entire city is enclosed by a large wooden fence, only the postal trucks (and citizens with proper passports) are allowed outside the city.

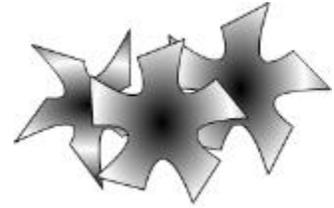
Match the parts of the city (underlined) with the parts of the cell.

1. Mitochondria _____
2. Ribosomes _____
3. Nucleus _____
4. Endoplasmic Reticulum _____
5. Golgi Apparatus _____
6. Protein _____
7. Cell Membrane _____
8. Lysosomes _____
9. Nuclolus _____

** Create your own analogy of the cell using a different model. Some ideas might be: a school, a house, a factory, or anything you can imagine*

Cell City Analogy - KEY

Original File: Cell City Analogy



In a far away city called Grant City, the main export and production product is the steel widget. Everyone in the town has something to do with steel widget making and the entire town is designed to build and export widgets. The town hall has the instructions for widget making, widgets come in all shapes and sizes and any citizen of Grant can get the instructions and begin making their own widgets. Widgets are generally produced in small shops around the city, these small shops can be built by the carpenter's union (whose headquarters are in town hall).

After the widget is constructed, they are placed on special carts which can deliver the widget anywhere in the city. In order for a widget to be exported, the carts take the widget to the postal office, where the widgets are packaged and labeled for export. Sometimes widgets don't turn out right, and the "rejects" are sent to the scrap yard where they are broken down for parts or destroyed altogether. The town powers the widget shops and carts from a hydraulic dam that is in the city. The entire city is enclosed by a large wooden fence, only the postal trucks (and citizens with proper passports) are allowed outside the city.

1. Mitochondria _____ **hydraulic dam** _____
2. Ribosomes _____ **small shops** _____
3. Nucleus _____ **town hall** _____
4. Endoplasmic Reticulum _____ **special carts** _____
5. Golgi Apparatus _____ **post office** _____
6. Protein _____ **widgets** _____
7. Cell Membrane _____ **fence** _____
8. Lysosomes _____ **scrap yard** _____
9. Nucleolus _____ **carpenter's union** _____

Match the parts of the city (underlined) with the parts of the cell.

** Create your own analogy of the cell using a different model. Some ideas might be: a school, a house, a factory, or anything you can imagine**

Excerpt from: “What in the Cell is Going on? - The Battle is over pH”

by Dr. Gary Tunsky

As you quietly read these words, a whirl of activity is taking place in every cell of your body. Every second, unseen, unnoticed, millions of new cells are reborn in your body's ceaseless program of self-generation. Since cells are the bricks and mortar from which all living tissue and organs are made, to understand degenerative and metabolic disease you must become familiar with the miniature world of the cell and how they are able to perform baffling chemical transformations producing infinitely complex proteins, vitamins, hormones, neurotransmitters, growth factors, enzymes and metabolic energy called ATP.

A healthy body is determined by the health of each of its single cells. All disease originates at the cellular level and not at the organ or system level. Healthy cells create healthy tissues. Healthy tissues create healthy organs like the heart and lungs. Healthy organs create healthy systems like the endocrine system or the immune system and healthy systems make up a healthy body.

In the complex world of 75 trillion cells that make up your nation body, you are the President (*the brain*) that delegates the police force that protects and shields the cellular citizens from attack by foreign enemies; the cellular citizen's work performance, transportation system, medical care, communication, food and water, and methods of toxic waste and trash removal. With your guidance and direction, the nation body will provide all the necessities for proper functioning as a whole. Your cell citizens come in all shapes, sizes and performance capabilities that manufacture an infinite variety of job tasks. Some reside in large cities that are your organs; others prefer to live in the outskirts in small towns away from the traffic - your fingernails for instance. But no matter where they reside, each cellular citizen has a purpose, an important duty for the good of the nation — your body.

So if the health of the cell is the answer, what constitutes a healthy cell? What you eat, drink, breathe and bathe in will either nourish the 75 trillion cells with oxygen, water, vitamins, minerals, phytonutrients, essential fatty acids (*EFAs*), glucose and amino acids, or contaminate the cells by the slow poisoning of the bloodstream. You see, what you breathe, whether oxygen or environmental contaminants ends up in the bloodstream. What you eat, whether living organic fruits, vegetables, nuts, grains, legumes and seeds or refined, processed, foodless foods and toxic sugar laden drinks end up after digestion in the bloodstream. The bloodstream is a flowing river to all the cells for nourishment and removal of acidic waste residues. So, is your bloodstream a river of life or a river of death and disease?

Cells are multifaceted. Some are like miniature electrical generators like a lithium battery. They all respire like a lung to bring in intelligent nutrients and remove toxic waste products. Cells are also manufacturing plants that synthesize hormones, neurotransmitters, proteins and life force. These cellular engines also communicate like a wireless fiber-optic network 24 hours a day. Our finite minds couldn't possibly fathom or consciously control the extraordinary complex tasks of manufacturing, storage, repair, communication, transportation, police, waste disposal, administration, food production, temperature control and pH balancing that goes on in our body daily to the normally metabolized acids from body tissues and maintain health and vitality.

A picture metaphor of how the cells communicate would be to envision all six billion people on this planet picking up a wireless phone simultaneously and having a phone conversation. Now picture everyone clicking three-way and having a three-way conversation. Then picture everyone in the world clicking on conference call with total conversation capability of 1,000 different people simultaneously. The question is, does your cell phone have good reception to transmit and receive messages. Your intestinal cell phone talks to the skin. Your spleen cell phone talks to the thymus. Your heart cell phone talks to the liver. All organs and systems work in unison. No organ or system works alone, just as no nutrient works alone. So what is the regulatory authority that controls cell processes? **The answer is pH.**

The pH of your tissues and body fluids affects the state of your health or inner cleanliness or filth. **The closer the pH is to 7.35 - 7.45, the higher you're level of health and well being and your ability to resist states of disease and the onset of symptomologies.**

The pH scale is like a thermometer showing increases and decreases in the acid and alkaline content of these fluids. Deviations above or below a 7.35 - 7.45 pH range in the blood can signal potentially serious and dangerous symptoms or states of disease. When the body can no longer effectively neutralize and eliminate the acids it relocates them within the body's extra-cellular fluids and connective tissue cells directly compromising cellular integrity.

Indeed the entire metabolic process depends on a balanced pH. As more acid wastes back up, and the body slowly stewes in its poisonous wastes, a chronically over acidic body pH corrodes body tissue, slowly eating into the 60,000 miles of our veins and arteries like acid eating into marble. This is what science calls hemorrhage. If left unchecked, it will interrupt all cellular activities and functions from the beating of your heart to the neuro firing of your brain. Over acidification interferes with life itself, leading to all sickness and "dis-ease." Fundamentally, all regulatory mechanisms, including breathing, ingestion, circulation, hormone production, neurotransmitter release, etc., serve the purpose of balancing pH by removing cells. When you eat food, it ferments, just the way a banana on your counter ferments from a green, to yellow, to brown, to black. The banana rots from the inside out, not from the outside in. That is why humans can look healthy from the outside but are rotting and decaying from the inside.

This is what the medical community refers to as degenerative disease. These morbid microforms produce potent acidic by-products, which further compromise pH and create disruption in the body's biosystem. This process can involve further morbidity through bacteria, yeast, fungus and mold with subsequent serious life-threatening symptomologies. I would say that disease comes from the inside out and that the terrain or environment of the body is the catalyst for the development and progression of all disease. This does not preclude the contributing factors from external circumstances such as trauma, airborne microforms, air pollution, radiation, chemicals and drugs. These all provide negative acidic impressions but "dis-ease" arises within the cell in response to these impressions.