Cell Theory and Cell Organelles

By:
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Science Methods

This is a 6 day unit plan covering: First Observation of cells, Cell Theory and the organelles of both Plant and Animal Cells. Some ideas I have come up with for grading are: a long term 3D model of cell, multiple worksheets, a rap on Cell Theory, an egg-speriment, and a seeing is believing project. I went away from old school tes and used more project and worksheets.
Day 1: First Observation of the Cell and Introduction of the 3D Cell project

Here is where you would start the unit. The first day would be introducing all the basics and all material that is going to be covered. To help the students understand that cells are not easily seen I’ve included a project called: Is Seeing Believing? Here also is a good time to introduce the long term 3D project that the students would be making. For this make sure the students understand that they may not understand all of it right away but they will know enough to start. In a day or 2 the students will have all the information needed to do the project.
Title: Is Seeing Believing?
Grade level/ Subject: 6 – 10 Life Science

Overview: Students will be cutting out a small section of a picture that is in black and white. Then from here the students will write down what they see. Then using a hand held magnifying class the students will then write down in detail what they see. From hear the students will take turns at a microscope and look at there piece and once again record what they see.

Purpose: This is to help the students see there is another world out there that they can’t see with their own eyes.

Objectives:
1. Students will understand that there is things out there that can’t been seen with eyes alone.

Materials
- Old Newspaper
- Scissors
- Hand held Magnifying glass
- Microscope
- Paper (for recording data)
- Writing item

Procedures:
1. Cut a black and white photograph out of a page in a newspaper. With you eyes only, closely examine the photo. Record your observation.
2. Examine the same photo but this time use a hand held magnifying glass.
3. Now take the same photo and place it under a microscope, using the clips to hold it in place. Shine the light onto the photo and bring the microscope into focus onto part of the photo. Once again record what you see.

Observing:
What did you see in the photo with the hand lens that you couldn’t see with your eyes? What did you see with the microscope that you couldn’t see with you eyes of the hand lens?
TITLE: MAKING THREE DIMENSIONAL PLANT AND ANIMAL CELLS  
(Long Term Project)  
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Battle Mountain, NV.  

GRADE LEVEL/SUBJECT: Appropriate for grades 6-10.  

OVERVIEW: Many students have trouble visualizing cells as 3-dimensional units, containing several different parts, working together. As they study pictures in text books, slides and videos, and look at leaves or their own skin, they often get the impression that cells are flat, 2-dimensional units.  

PURPOSE: The purpose of this activity is to provide students with a hands-on activity which will enhance their understanding of the 3-D characteristics of cells while reinforcing their knowledge of plant and animal cell structure.  

OBJECTIVES: Students will be able to:  
1. Compare and contrast the structures of plants and animals.  
2. Demonstrate and understand the 3-dimensional aspect of cell structure.  
3. Identify the various parts of plant and animal cells.  

RESOURCES/MATERIALS:  
Play-doe, food coloring or tempera paints (red, purple, green, blue), 1 pair disposable gloves, yarn or undercooked spaghetti, pepper, plastic-bubble packing, aluminum foil, plastic wrap, pencil shavings, scissors, 1 large knife, glue  

Cell structure list and possible materials for each group:  
1. Cytoplasm -- play-doe (plain - approx. 260g or 8oz)*  
2. Endoplasmic reticulum -- yarn or cooked spaghetti  
3. Ribosomes -- pepper  
4. Mitochondria -- play-doe (purple - approx. 7g)**  
5. Vacuole -- plastic-bubble packing  
6. Lysosome -- play-doe (red - approx. 5g)  
7. Chloroplasts -- play-doe (green - approx. 10g)  
8. Cell wall -- aluminum foil (approx. 12" X 7")  
9. Cell membrane -- plastic wrap (approx. 12" X 16")  
10. Nucleus -- play-doe (blue - approx. 20g)  
11. Nuclear membrane -- plastic wrap (approx. 3"X6")  
12. Chromosomes -- pencil shavings  

* Play-doe recipe: This makes about 850g (30oz) - enough for 3 groups.  
1 C soda (salt for baking)  
4 t cream of tarter  
1 C flour  
2 T oil  
1 C corn starch  
1-3/4 C water
Stove top method: Mix and cook until the dough leaves the side of pan. Cool on plate with wet cloth on top.
Oven method: Bake @ 150 F overnight.
** To color play-doe use food coloring or tempera paints. (Using rubber or disposable gloves is a good idea.)

ACTIVITIES AND PROCEDURES:
1. After studying cell structure, divide the class into small groups.
2. Gather all materials and have them laid out according to the number of student groups. (See material list below.)
3. Distribute materials and lists of cell structures to each group.
4. Inform groups they will be making two cells – one plant and one animal cell. When they finish, each cell will be about the size of a tennis ball. The first part of the class period will be spent making the cell structures themselves. Instruct them to wait before putting the cells together until you can explain the procedure. Have group leaders assign responsibility, for each cell part, to the group members. (The cell structure list also includes possible materials which could be used. These materials could be expanded or substituted.)
5. Have the "cell membrane people" cut the large piece of plastic wrap in half and place each piece on the table.
6. Have the "cytoplasm people" form 2 balls using the plain play-doe or clay. Lay 1 ball on each piece of plastic wrap and press each into a "pancake" about 6".
7. Instruct them to designate one pancake, "animal cell" and the other "plant cell".
8. Have members of each group find the supplies the need to represent their cell structures, cut, form, fold, paste, etc. until their structure is simulated. Then place the finished structures in a pile on the center of the appropriate pancake. (Exception -- cell wall)
9. When all of the cell parts are completed and in place, have someone in each group "gather up" the pancake carefully cupping it around its "topping" and seal all of the edges together forming a ball. Next have the "cell membrane people" wrap the plastic wrap around the cytoplasm and have the "cell wall people" wrap the aluminum foil around the plant cell.
10. Depending on the length of time available, cells may be set aside for the next class period or each may be cut in half with a large knife right away.
Day 2: Cell Theory, Rap, Start Egg-sperament

On day 2 you actually start talking about the concepts and idea behind cells. To begin you have to start with the Cell Theory. In order to help I included information that also has important date in Cell history. In order to help understand this I have included a Cell Rap that will prove to be fun and interesting. With about 15 minutes left in class you are going to want to introduce the Egg-sperament. This will be taking place over the next 4 days.
The CELL THEORY, or cell doctrine, states that all organisms are composed of similar units of organization, called cells. The concept was formally articulated in 1839 by Schleiden & Schwann and has remained as the foundation of modern biology. The idea predates other great paradigms of biology including Darwin's Origin of Species (1859), Mendel's Principles of Heredity (1865), and the establishment of the electron microscope (1940).

Ultrastructural research and modern molecular biology have added many tenets to the cell theory, but it remains as the preeminent theory of biology. The Cell Theory is to biology as Atomic Theory is to Physics.

Formulation of the Cell Theory

In 1838, Theodor Schwann and Matthias Schleiden were enjoying after-dinner coffee and talking about their studies on cells. It has been suggested that when Schwann heard Schleiden describe plant cells with nuclei, he was struck by the similarity of these plant cells to cells he had observed in animal tissues. The two scientists went immediately to Schwann’s lab to look at his slides. Schwann published his book on animal and plant cells (Schwann 1839) the next year, a treatise devoid of acknowledgments of anyone else’s contribution, including that of Schleiden (1838). He summarized his observations into three conclusions about cells:

The cell is the unit of structure, physiology, and organization in living things.

The cell retains a dual existence as a distinct entity and a building block in the construction of organisms.

Cells form by free-cell formation, similar to the formation of crystals (spontaneous generation).

We know today that the first two tenets are correct, but the third is clearly wrong. The correct interpretation of cell formation by division was finally promoted by others and formally enunciated in Rudolph Virchow’s powerful dictum, "Omnis cellula e cellula"... "Von Einzelzelle zu Zelle..."

The implications of the Cell Theory include:

all known living things are made up of cells.
the cell is structural & functional unit of all living things. all cells come from pre-existing cells by division. (Spontaneous Generation does not occur). cells contains hereditary information which is passed from cell to cell during cell division. All cells are basically the same in chemical composition. all energy flow (metabolism & biochemistry) of life occurs within cells.

As with any theory, its tenets are based upon previous observations and facts, which are synthesized into a coherent whole via the scientific method. The Cell Theory is no different being founded upon the observations of many. (Landmarks in the Study of Cells)

Credit for the first compound (more than one lens) microscope is usually given to Zacharias Jansen, of Middleburg, Holland, around the year 1595. Since Jansen was very young at that time, it's possible that his father Hans made the first one, but young Jansen perfected the production. Details about the first Jansen microscopes are not clear, but there is some evidence which allows us to make some guesses about them (Jansen microscopes).

In 1663 an English scientist, Robert Hooke, discovered cells in a piece of cork, which he examined under his primitive microscope (figures). Actually, Hooke only observed cell walls because cork cells are dead and without cytoplasmic contents. Hooke drew the cells he saw and also coined the word CELL. The word cell is derived from the Latin word 'cellula' which means small compartment. Hooke published his findings in his famous work, Micrographia: Physiological Descriptions of Minute Bodies made by Magnifying Glasses (1665).

Ten years later Anton van Leeuwenhoek (1632-1723), a Dutch businessman and a contemporary of Hooke used his own (single lens) monocular microscopes and was the first person to observe bacteria and protozoa. Leeuwenhoek is known to have made over 500 "microscopes," of which fewer than ten have survived to the present day. In basic design, probably all of Leeuwenhoek's instruments were simply powerful magnifying glasses, not compound microscopes of the type used today. Leeuwenhoek's skill at grinding lenses, together with his naturally acute eyesight and great care in
adjusting the lighting where he worked, enabled him to build microscopes that magnified over 200 times, with clearer and brighter images than any of his colleagues at that time. In 1673, Leeuwenhoek began writing letters to the newly formed Royal Society of London, describing what he had seen with his lenses. His first letter contained some observations on the stings of bees. For the next fifty years he corresponded with the Royal Society. His observations, written in Dutch, were translated into English or Latin and printed in the *Philosophical Transactions of the Royal Society*. Leeuwenhoek looked at animal and plant tissues, at mineral crystals, and at fossils. He was the first to see microscopic single celled protists with shells, the foraminifera, which he described as "little cockles... no bigger than a coarse sand-grain." He discovered blood cells, and was the first to see living sperm cells of animals. He discovered microscopic animals such as nematodes (round worms) and rotifers. The list of his discoveries is long. Leeuwenhoek soon became famous as his letters were published and translated. In 1680 he was elected a full member of the Royal Society. After his death on August 30, 1723, a member of the Royal Society wrote... "Antony van Leeuwenhoek considered that what is true in natural philosophy can be most fruitfully investigated by the experimental method, supported by the evidence of the senses; for which reason, by diligence and tireless labour he made with his own hand certain most excellent lenses, with the aid of which he discovered many secrets of Nature, now famous throughout the whole philosophical World". No truer definition of the scientific method may be found.

Between 1680 and the early 1800's it appears that not much was accomplished in the study of cell structure. This may be due to the lack of quality lens for microscopes and the dedication to spend long hours of detailed observation over what microscopes existed at that time. Leeuwenhoek did not record his methodology for grinding quality lenses and thus microscopy suffered for over 100 years.

German natur-philosopher and microscopist, Lorenz Oken had been trained in medicine at Freiburg University. He went on to become a renown philosopher and thinker of the 29th century. It is reported that in 1805 Oken stated that "All living organisms originate from and consist of cells"... which may have been the first statement of a cell theory.
Around 1833 Robert Brown reported the discovery of the nucleus. Brown was a naturalist who visited the "colonies of Australia" from 1801 through 1805, where he cataloged and described over 1,700 new species of plants. Brown was an accomplished technician and an extraordinarily gifted observer of microscopic phenomena. It was Brown who identified the naked ovule in the gymnospermae. This is a difficult observation to make even with a modern instrument and the benefit of hindsight. But it was with the observation of the incessant agitation of minute suspended particles that Brown's name became inextricably linked. The effect, since described as Brownian Movement, was first noticed by him in 1827. Having worked on the ovum, it was natural to direct attention to the structure of pollen and its Brown interrelationship with the pistil. In the course of his microscopic studies of the epidermis of orchids, discovered in these cells "an opaque spot," which he named the nucleus. Doubtless the same "spot" had been seen often enough before by other observers, but Brown was the first to recognize it as a component part of the vegetable cell and to give it a name. This nucleus (or areola as he called it) of the cell, was not confined to the epidermis, being also found, in the pubescence of the surface and in the parenchyma or internal cells of the tissue. This nucleus of the cell was not confined to only orchids, but was equally manifest in many other monocotyledonous families and in the epidermis of dicotyledonous plants, and even in the early stages of development of the pollen. In some plants, as Tradescantia virginica, it was uncommonly distinct, especially in the tissue of the stigma, in the cells of the ovum, even before impregnation, and in all the stages of formation of the grains of pollen.

It is upon the works of Hooke, Leeuwenhoek, Oken, and Brown that Schleiden and Schwann built their Cell Theory. It was the German professor of botany at the University of Jena, Dr. M. J. Schleiden, who brought the nucleus to popular attention, and to asserted its all-importance in the function of a cell. Schleiden freely acknowledged his indebtedness to Brown for first knowledge of the nucleus, but he soon carried out his own observations of the nucleus, far beyond those of Brown. He came to believe that the nucleus is really the most important portion of the cell, in that it is the original structure from which the remainder of the cell is developed. He called it the . He outlined his views in an epochal paper published in Muller's Archives in 1838, under title of "Beitrage zur Phytogenesis." This paper is in itself of value, yet the most important outgrowth of Schleiden's
observations of the nucleus did not spring from his own labors, but from those of a friend to whom he mentioned his discoveries the year previous to their publication. This friend was Dr. Theodor Schwann, professor of physiology in the University of Louvain.

Schwann was puzzling over certain details of animal histology which he could not clearly explain. He had noted a strange resemblance of embryonic cord material, from which the spinal column develops, to vegetable cells. Schwann recognized a cell-like character of certain animal tissues. Schwann felt that this similarity could not be mere coincidence, and it seemed to fit when Schleiden called his attention to the nucleus. Then at once he reasoned that if there really is the correspondence between vegetable and animal tissues that he suspected, and if the nucleus is so important in the vegetable cell as Schleiden believed, the nucleus should also be found in the ultimate particles of animal tissues. A closer study of animal tissues under the microscope showed, in particular in embryonic tissues, that the "opaque spots" that Schleiden described were found in abundance. The location of these nuclei at comparatively regular intervals suggested that they are found in definite compartments of the tissue, as Schleiden had shown to be the case with vegetables; indeed, the walls that separated such cell-like compartments one from another were in some cases visible. Soon Schwann was convinced that his original premise was right, and that all animal tissues are composed of cells not unlike the cells of vegetables. Adopting the same designation, Schwann propounded what soon became famous as the CELL THEORY. So expeditious was his observations that he published a book early in 1839, only a few months after the appearance of Schleiden's paper.

The main theme of his book was to unify vegetable and animal tissues. Accepting cell-structure as the basis of all vegetable tissues, he sought to show that the same is true of animal tissues.

And by cell Schwann meant, as did Schleiden also, what the word ordinarily implies—a cavity walled in on all sides. He knew that the cell might be filled with fluid contents, but he regarded these as relatively subordinate in importance to the nucleus and cell wall.

Their main thesis, the similarity of development of vegetable and animal tissues and the cellular nature of life, was supported almost immediately by
a mass of carefully gathered evidence which a multitude of microscopists confirmed. So Schwann's work became a classic almost from the moment of its publication. Various other workers disputed Schwann's claim to priority of discovery, in particular an English microscopist, Valentin, who asserted that he was working closely along the same lines. So did many others, such as Henle, Turpin, Du-mortier, Purkinje, and Muller, all of whom Schwann himself had quoted in his work. Many physiologists had, earlier than any of the above, foreshadowed the cell theory, including Kaspar Friedrich Wolff around the close of the previous century, and Treviranus in 1807.

But, as we have seen in the scientific method, it is one thing to foreshadow a discovery, it is quite another to give it full expression and make it the cornerstone of future discoveries. And when Schwann put forward the explicit claim that "there is one universal principle of development for the elementary parts, of organisms, however different, and this principle is the formation of cells," he enunciated a doctrine which was for all practical purposes absolutely new and opened up a novel field for the microscopist to enter. A most important era in Cell Biology dates from the publication of his book in 1839.

Landmarks in Study of Cell Biology

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
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<tbody>
<tr>
<td>1595</td>
<td>Jansen credited with 1st compound microscope</td>
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<tr>
<td>1626</td>
<td>Redi postulated that living things do not arise from spontaneous generation.</td>
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<tr>
<td>1655</td>
<td>Hooke described 'cells' in cork.</td>
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<tr>
<td>1674</td>
<td>Leeuwenhoek discovered protozoa. He saw bacteria some 9 years later.</td>
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<tr>
<td>1833</td>
<td>Brown described the cell nucleus in cells of the orchid.</td>
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<tr>
<td>1838</td>
<td>Schleiden and Schwann proposed cell theory.</td>
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<td>1840</td>
<td>Albrecht von Roëlliker realized that sperm cells and egg cells are also</td>
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<td>Year</td>
<td>Event</td>
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<tr>
<td>1856</td>
<td>N. Pringsheim observed how a sperm cell penetrated an egg cell.</td>
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<td>1858</td>
<td>Rudolf Virchow (physician, pathologist and anthropologist) expounds his famous conclusion: <em>omnis cellula e cellula</em>, that is <em>cells develop only from existing cells</em> [cells come from preexisting cells]</td>
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<tr>
<td>1857</td>
<td>Kolliker described mitochondria.</td>
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<td>1869</td>
<td>Miescher isolated DNA for the first time.</td>
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<td>1879</td>
<td>Flemming described chromosome behavior during mitosis.</td>
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<td>1883</td>
<td>Germ cells are haploid, chromosome theory of heredity.</td>
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<tr>
<td>1898</td>
<td>Golgi described the <em>golgi apparatus</em>.</td>
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<td>1926</td>
<td>Svedberg developed the first analytical ultracentrifuge.</td>
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<tr>
<td>1938</td>
<td>Behrens used <em>differential centrifugation</em> to separate nuclei from cytoplasm.</td>
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<tr>
<td>1939</td>
<td>Siemens produced the first commercial <em>transmission electron microscope</em>.</td>
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<tr>
<td>1941</td>
<td>Coons used <em>fluorescent labeled antibodies</em> to detect cellular antigens.</td>
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<tr>
<td>1952</td>
<td>Gey and co-workers established a continuous human cell line.</td>
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<td>1953</td>
<td>Crick, Wilkins and Watson proposed structure of DNA double-helix.</td>
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<tr>
<td>1955</td>
<td>Eagle systematically defined the nutritional needs of animal cells in culture.</td>
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<tr>
<td>1957</td>
<td>Meselson, Stahl and Vinograd developed density gradient centrifugation in cesium chloride solutions for separating nucleic acids.</td>
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<td>Year</td>
<td>Event</td>
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<tr>
<td>1965</td>
<td>Ham introduced a defined serum-free medium. Cambridge Instruments produced the first commercial scanning electron microscope.</td>
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<tr>
<td>1976</td>
<td>Sato and colleagues publish papers showing that different cell lines require different mixtures of hormones and growth factors in serum-free media.</td>
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<tr>
<td>1981</td>
<td>Transgenic mice and fruit flies are produced. Mouse embryonic stem cell line established.</td>
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<tr>
<td>1987</td>
<td>First knockout mouse created.</td>
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<tr>
<td>1998</td>
<td>Mice are cloned from somatic cells.</td>
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<tr>
<td>2000</td>
<td>Human genome DNA sequence draft.</td>
</tr>
</tbody>
</table>
Cell Theory Rap

Listen close to the story I tell.
It's the rapping story of the living cell.
It's a happy tune that's sort of cheery.
About a real tough topic called the cell theory.

All animals, plants, and protists too,
Are made of cells with different jobs to do.
They're the basic units of all organisms,
And I hope by now you got the rhythm.

It all started with one dude named Hooke.
Who at some cork cells took a look.
He used a scope and took his time,
'Cause a cell is small and thinner than a dime.

Say 1, 2, 3, 4,
Are you ready to learn some more?
The animal cell has many parts,
And you must know each one by heart.

Like the farmer man in the dell.
The nucleus controls the cell.
It gives the orders -- kind of like a brain.
And it's protected by a nuclear membrane.

Around the cell, you'll find another "skin,"
The cellular membrane holds the whole cell in
But its job isn't simple there's no doubt,
It lets some particles go in and out.

Now please don't lose your science enthusiasm,
Listen to the story of the cytoplasm.
All around the cell this thick fluid does go,
But in the nucleus it will not flow.

And don't forget those ribosomes -
This is where proteins come from.
These protein factories are so small, you'll agree,
You need an electron microscope to see.

Just when you thought you weren't having any fun,
Along comes the endoplasmic reticulum.
These tubelike structures serve as a track,
To carry stuff to the membrane and back.

Now have you ever seen any doughnuts without holes?
In a cell, they're called vacuoles.
They're filled with stuff like H2O.
Cell Theory Rap

And they carry food so the cell can grow.

Las of all, but not the very least,
Mitochondria - mighty cellular beasts,
Since they turn sugars into energy so well,
We call them the powerhouse of the cell.

Now my friend, you know it well,
The unforgettable story of the living cell.

"Science World"
10-5-90
Title: Egg-sperament
Grade level/ Subject: 6 – 10 Life Science

Overview: Using 5 liquids you will soak a raw eye in them, and measure the diameter of each after everyday.

Purpose: To observe how various materials enter or leave a cell, using an egg as a model of the cell.

Materials:
- Raw eggs
- Vinegar
- H2O
- Food coloring
- Salt water
- Any other liquid you choose

Procedures:
1. Observe what happens when you soak an uncooked egg in vinegar, then in water, food coloring, salt water, and finally a liquid of your choice.
2. Measure the circumference of the egg everyday, and graph your results.
3. Explain the changes that you observe in your egg.
Name:  
Date:  

Directions: Record the circumference of each egg everyday for 4 days. Then on a separate sheet of paper record what you observe. Mainly focus on the changes that occur. Then after the 4 days make a graph for each egg. Any type of graph will do.

Vinegar  
1.  
2.  
3.  
4.  
5.  

Water  
1.  
2.  
3.  
4.  
5.  

Food Coloring  
1.  
2.  
3.  
4.  
5.  

Salt Water  
1.  
2.  
3.  
4.  
5.  

You Choice  
1.  
2.  
3.  
4.  
5.
Day 3: Cell Rap Cont., Parts of the Animal cell, and Animal Cell Worksheet

To start class of have the class go ahead and review the Cell Rap and see if anyone is brave enough to try and recite from memory. Ask how their take home projects are going. From here it’s a good time to start going over the animal cell’s history and the organelles. Explain what each organelle does. In order to help the students study, have them do the coloring worksheet. Have them measure out all of the egg-sperament samples and record.
Animal Cell Coloring

Directions: Choose a color for each of the parts below and fill in the square with the color of your choice. Color the cell part to match.

- Cell Membrane
- Cytoplasm
- Nucleoplasm
- Nuclear Membrane
- Nucleolus
- Golgi Apparatus
- Flagella
- Ribosome
- Smooth Endoplasmic Reticulum
- Rough Endoplasmic Reticulum
- Mitochondria
- Lysosome
- Microtubules
Briefly describe the function of the cell parts.

1. Cell membrane
2. Endoplasmic Reticulum
3. Ribosome
4. Golgi Apparatus
5. Lysosome
Animal Cell Coloring

6. Microtubule
7. Mitochondria
8. Nucleus
Day 4: Cell Rap Cont., Parts of the Plant cell, and Plant Cell Worksheet

To start class of have the class go ahead and review the Cell Rap and see if anyone is brave enough to try and recite from memory. Ask how their take home projects are going. From here it's a good time to start going over the plant cell's history and the organelles. Explain what each organelle does. In order to help the students study, have them do the coloring worksheet. Have them measure out all of the egg-sperament samples and record.
**Plant Cell Coloring**

Directions: Choose a color for each of the parts below and fill in the square with the color of your choice. Color the cell part to match.

<table>
<thead>
<tr>
<th>Part</th>
<th>Color</th>
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</thead>
<tbody>
<tr>
<td>Cell Membrane</td>
<td></td>
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<tr>
<td>Cytoplasm</td>
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<tr>
<td>Nucleoplasm</td>
<td></td>
</tr>
<tr>
<td>Nuclear Membrane</td>
<td></td>
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<tr>
<td>Nucleolus</td>
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<tr>
<td>Golgi Apparatus</td>
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<td>Ribosome</td>
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<tr>
<td>Smooth Endoplasmic Reticulum</td>
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<td>Rough Endoplasmic Reticulum</td>
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<td>Mitochondria</td>
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<tr>
<td>Chloroplasts</td>
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<tr>
<td>Microtubules</td>
<td></td>
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<tr>
<td>Cell Wall</td>
<td></td>
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</tbody>
</table>
Compare and Contrast the animal cell to the plant cell - that is, describe how they are alike, and how they are different.
9. Nucleolus

**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**
Day 5: Egg-sperament wrap of, Review Cell Rap, and Worksheet

Have the students come in and do their last bit of recording for the egg-sperament, and explain the guide lines for the graphs once more. Here is another to work on the Cell Rap again. For some extra practice have the students do the Cell city worksheet in class. Have any questions and answer period for the test.
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.

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. Nucleolus

** 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**
Day 6: Test day

Have the students turn in the cell city sheet if they didn’t and also turn in the egg-speriment. In order for this to be fair have all the students name in a hat and you will be randomly drawing names for the order they are to go in. All the students will need to recite the entire Rap in front of the class. Seems how the major grading criteria for this is the 3D model let the students know they will have 1 more week form today to have it completed and turned in.