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| **Title**  | **Cell Analogy Book: Using Analogies to Understand and Remember Organelle Function** |
| **Introduction**  | Students will evaluate the functions of cell organelles by creating a children’s book of analogies relating the role of each organelle to everyday objects. Students will then work cooperatively to create an online collage of their best analogies using padlet.com formerly wallwisher.com. |
| **Curriculum Alignment**  | HS Biology - NC Essential Standards Biology***Bio.1.1*** *Understand the relationship between the structures and functions of cells and their organelles*.* **Bio.1.1.1** Summarize the structure and function of organelles in eukaryotic cells (including: the nucleus, plasma membrane, cell wall, mitochondria, vacuoles, chloroplasts, and ribosomes) and ways that these organelles interact with each other to perform the function of the cell.
* **Bio.1.1.2** Compare prokaryotic and eukaryotic cells in terms of their general structures (plasma membrane and genetic material) and degree of complexity.

***Bio.1.2*** *Analyze the cell as a living system.* |
| **Learning Outcomes**  | The learner will analyze the functions of cell organelles using iPods or Smartphone technology.The learner will create analogies to relate the function of each organelle to an everyday object. The learner will generate a children’s book of all their analogies and pictures. The learner will work cooperatively to compile their ideas into one product. The learner will use technology to create an online collage of their cell analogies.  |
| **Time Required and Location**  | * 4 class periods, 90 minutes in length or
* 6 class periods, 50 minutes in length with some homework assigned
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| **Materials Needed**  | Materials needed include resources used by both teacher and student, including books, handouts, paper and pencils, art supplies, and so on.* Construction paper
* Glue sticks
* Scissors
* Magazines (preferably *Good Housekeeping*, *Martha Stewart* etc)
* Ice cream machine/slushy machine/coffee maker
* SMART Board for lesson overview and preparing a chart of organelle functions.
* iPods/smartphones with internet connection for identifying the functions of the organelles. Textbooks could be substituted.
* Laptops for researching organelle functions as well as for creating the digital ebook.

**Technology resources*** SMART Board
* iPod or Smartphone device with Wi-Fi connection
* 1 Laptop per 3-4 students for researching organelle functions and creating the digital collage: could be replaced with textbooks and the collage could be created in a computer lab
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| **Participant Prior Knowledge**  | Prior to this lesson, I have introduced students to the structure and functions of the major biological molecules. Students also analyzed the differences between prokaryotic and eukaryotic cells in terms of basic structures and complexity.  |
| **Facilitator Preparations**  | Teacher needs to set up stations for the first day with slides of various cells to include both plant and animal cells. Teacher should also ensure that Wi-Fi connection is available and post the appropriate connection steps if applicable. Teacher will also need to set up laptop stations for each group for creating the digital collage.An online collaboration needs to be set up on WallWisher.com. Teachers can create a free account by registering with an email. Then on the home page teachers are directed to “Build A Wall.” After clicking on that icon teachers will need to choose a URL for their webpage. I would suggest using some form of the class period. They also need to make sure that everyone can view and everyone can contribute so all students are able to post to the wall. The website will also direct wall builders to create a name for their wall as well. After the wall is created, make note of the URL to share with students. |
| **Activities**  | **Exploration:** Bring in a simple kitchen machine like an ice cream maker, although a slushy machine or even a coffee pot would work as well. Demonstrate to the students how the machine works emphasizing that you put certain ingredients in and then a product results. Have students brain storm the parts of your machine that they think are necessary for the machine to produce the product, emphasizing both the internal and external components. Then show students a picture of a cell discuss how it too looks like it has parts as well. Lead discussion about what parts must be needed for the cell to produce its product, proteins. This is a good opportunity to review the monomers and polymers as well. When finished with your discussion, students could possibly sample the product as well if a slushy or ice cream machine was used. Then post a chart of each of the cell organelles with a blank column for the function of each, as well as a spot for a simple sketch. Have students organize into groups of 2-3 students per iPod or Smartphone device and instruct students to utilize Google to fill into the information. Students will organize their information into the chart. Include the following organelles: nucleus, endoplasmic reticulum, lysosome, golgi apparatus, ribosome, vacuole, chloroplast, mitochondria, cell membrane, cell wall, centriole, and cilia/flagella. Honors classes should also include: nucleolus, rough and smooth endoplasmic reticulum. Then have student volunteers fill in the chart on the board and to check for clarification. Then post pictures of a plant cell and an animal cell side by side. Ask students what is similar about the two cells? Then ask them to tell you what is different about the two cells. Lead discussion to include the boxy plant cell shape, that the plant cell has a cell wall and chloroplasts, and that the animal cells have cilia/flagella and centrioles. Then use a PowerPoint presentation to explain the difference between plant and animal cells. Have students take guided notes to ensure active engagement in the lecture. Then show the students a picture of the floor plan of a factory side-by-side with a picture of a cell. Have the students complete a fast write comparing and contrasting the two. Then discuss with students why factories need different departments/machines and why cells may also need different parts.  **Model System:** Day 2  Have students practice their analogy skills with the Cell City Analogy Worksheet. Check for clarification as a class. Emphasize that the function of the factory is to make the widget just like the cell makes proteins. Then introduce the students to their project through the PowerPoint Presentation titled Cell Analogy Book. Stress that the focus is on the functions of the cell organelles and not what the organelles themselves look like. Allow students the rest of the period and the entire period the following day to work on finding objects to create analogies. When students are beginning to put their cell books together discuss the format of an analogy and that students must identify both objects in their analogy and link together the function. Day 3When students have completed their Cell Analogy Books place them into groups of 4. Set a timer for 3 minutes with 1 minute increments. Tell students to pass their book to the right and each spend a minute reading each other’s book. Each student should have a piece of scratch paper to jot down the analogies they like the best from their classmate’s books. When students are finished them give one minute to create a list of their favorite organelle analogies in order. When students are finished tell them to place their lists in the middle and compare their results. According to which organelle analogies appear most frequently students will compile a list of their top 8 analogies, each for a different organelle. Students will then be given instructions on how to contribute to the class online collage on Wellwisher.com by directing them to the teacher created wall via the wall website. Students will be instructed to make 8 posts, one for each of their top 8 analogies. Students will conduct a Google search to find images that are similar to their selected analogy images online and link them to their posts on the collage along with their analogies. Students do not even have to register for an account if they post as an anonymous user and include their group initials in their analogy post. Students will be given laptops with WiFi connection in order to work on their product. At least one laptop per group will be needed. View an example WallWisher collage at <http://www.wallwisher.com/wall/Alston_Bio_1st>**Content Wrap-Up:** Students will participate in a teacher-led discussion to reiterate the functions of each of the cell organelles. To review the functions of the organelles the teacher will share a PowerPoint Presentation with the students. After each organelle, the teacher will direct students back to the class Wallwisher.com page where they will be asked to point out the different analogies that were used for that particular organelle. **Guided Practice** * Cell Function Chart
* Cell City Analogy
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| **Assessment**  | Individual student projects will be assessed according to a rubric. Group projects will be graded according to a rubric as well as a peer grading sheet.  |
| **Critical Vocabulary**  | * Analogy – a similarity between like features of two things, on which a comparison may be based
* [Cell](http://library.thinkquest.org/12413/theory.html#cell) - the smallest unit of life that carries out its own processes
* [Centrioles](http://library.thinkquest.org/12413/structures.html#centrioles) - essential tubular organelles found near the nucleus in pairs that aid in cellular division
* [Chloroplasts](http://library.thinkquest.org/12413/structures.html#chloroplasts) - membrane-bound organelles containing chlorophyll that is found in photosynthetic organisms
* [Endoplasmic reticulum](http://library.thinkquest.org/12413/structures.html#er) - the cell's highway transport system composed of tubes and membranes connected to the nuclear membrane and extending through the cytoplasm that is also utilized for storing and separating
* [Eukaryotes](http://library.thinkquest.org/12413/eukaryotes.html) - advanced cell type with a nuclear membrane surrounding genetic material and numerous membrane-bound organelles dispersed in a complex cellular structure
* [Flagellum](http://library.thinkquest.org/12413/protist.html#flagellum) - an extension on many unicellular organisms that enables movement through whip-like motions
* [Golgi apparatus](http://library.thinkquest.org/12413/structures.html#golgi) - multi-layered organelle near the nucleus used for packaging of materials to be transported out of the cell
* [Lysosomes](http://library.thinkquest.org/12413/structures.html#lysosome) - the digestive plants of food for the cell, changes shape from task to task
* [Mitochondria](http://library.thinkquest.org/12413/structures.html#mitochondria) - genetically independent organelles that produce energy for the cells along their many internal folds
* [Nucleus](http://library.thinkquest.org/12413/structures.html#nucleus) - spherical organelle that is the cell's control center
* [Plasma membrane](http://library.thinkquest.org/12413/structures.html#plasma) - outer membrane of cells composed of proteins and a phospholipid bi-layer that controls cellular traffic
* [Plasma membrane](http://library.thinkquest.org/12413/structures.html#plasma) - outer membrane of cells composed of proteins and a phospholipid bi-layer that controls cellular traffic
* [Ribosomes](http://library.thinkquest.org/12413/structures.html#ribosomes) - extremely small grain-like organelle that provides the sites for protein synthesis (they may be free in the cytoplasm or attached to the endoplasmic reticulum)
* [Vacuoles](http://library.thinkquest.org/12413/structures.html#vacuoles) - membrane-bound organelles in the cytoplasm that are used for storage and digestion

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| **Modifications**  | Lower-level learners or LEP students can be provided with a sentence frame in order to assist them with writing their analogies.  |
| **Alternative Assessments**  | Students requiring modifications may be given a shortened list of organelles to use for their analogies and the rubric therefore adjusted accordingly.  |
| **Supplemental Information**  | * Cell City Teacher Page - <http://scorescience.humboldt.k12.ca.us/fast/teachers/Internauts/teacherpage.htm> This website gives an example of some analogies pertaining to cell organelles.
* Cell Organelle Function Chart - <http://www.biologyjunction.com/cell_functions.htm> This is a chart much like what the students will create in their exploration.
* WallWisher - [www.wallwisher.com](http://www.wallwisher.com)
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| **Comments**  | I developed this lesson in an effort to help students remember the functions of the cell organelles. It seemed that students had little problems identifying the organelles themselves, however even higher level students struggled remembering the functions. I started this lesson as a poster collage and have adjusted it to better suit the needs of the students. I have often heard the students recalling their pictures when reviewing for the EOC test (“Oh the lysosome! That was like my bleach wipes!”) which indicates to me that the assignment has at least in some part been successful. |
| **Author Info**  | Willow Alston is in her eighth year of teaching at Hoke County High School in Raeford, North Carolina. She teaches 9-12 science but has concentrated most of her career teaching Anatomy and Physiology and Biology. Willow has a BS in Biology with a Minor in Chemistry and is currently working on her Master’s in School Administration. This project was developed to give students a way to easily relate cell organelles to objects they relate to. North Carolina curriculum standards specifically require students to recall and apply the functions of the organelles so by creating an analogy students are able to more easily recall and relate. By creating a paper copy of the Cell Analogy Book students are able to have a tangible review tool to refresh their memory throughout the semester. As well by creating a WallWisher.com collage students are able to create a digital copy as well as practice collaboration skills with their cooperative learning group. |