Cells: The Inside Story

Overview

Description
In this activity, students will research the structure and function of major cell organelles and use an analogy to another system to describe the functions. Students will communicate their understanding in a digital slideshow and a written narrative.

Final Product: Students will create digital slideshows on the structure and function of major cell organelles and present them to the class. Students will also create a written narrative structured around an analogy to a familiar system.

Course
Biology

Task Level
Grades 9–12

Cross-Disciplinary Standards Assessed

I. Key Cognitive Skills
   B.2. Construct well-reasoned arguments to explain phenomena, validate conjectures, or support positions.
   D.1. Self-monitor learning needs and seek assistance when needed.
   D.2. Use study habits necessary to manage academic pursuits and requirements.
   D.4. Persevere to complete and master tasks.
   E.1. Work Independently.
   F.1. Attribute ideas and information to source materials and people.
   F.4. Understand and adhere to ethical codes of conduct.

II. Foundational Skills
   A.4. Identify the key information and supporting details.
   B.1. Write clearly and coherently using standard writing conventions.
   B.2. Write a variety of forms for various audiences and purposes.
   C.5. Synthesize and organize information effectively.
   C.6. Design and present an effective product.
C.7. Integrate source material.
C.8. Present final product.
E.1. Use technology to gather information.
E.3. Use technology to communicate and display findings in a clear and coherent manner.

Science Standard Assessed

VI. Biology

A.1. Describe the structure and function of major sub-cellular organelles.

Objectives

Students will:

• Understand the role of sub-cellular organelles in the structural hierarchy of life.
• Develop diagrams and descriptions of cell organelles.
• Demonstrate an understanding of cell organelle function by developing and explaining an analogy to an existing system such as a city, school, or family.
• Compile cell organelle research into a digital slideshow.
• Use original digital images or cited public domain images to illustrate the structure of cell organelles.

Preparation

• Read the Instructor Task Information and the Student Notes.
• Prepare copies of the Student Note pages and the Information Summary handout.
• Obtain 11 index cards for each student.
• Prepare a sample digital slide on one cell organelle, using the city analogy.
• Develop a list of possible resources and references for research.
• Provide students with a list of possible analogies from which to choose.
• Prepare to share the scoring guide with students as they create their slide shows and narratives.

Prior Knowledge

Students should have experience using the Internet for research. Students must be able to locate and download public domain images. Students should have basic
understanding of the hierarchy of organization of organisms (whole organism, organ systems, organs, tissues, cells, cell organelles, etc.).

**Vocabulary**

- Cell membrane (or plasma membrane)
- Centriole
- Chloroplast
- Cilia
- Cytoskeleton
- Endoplasmic reticulum
- Flagella
- Golgi apparatus
- Lysosome
- Mitochondrion
- Nucleus
- Organelle
- Ribosome
- Sub-cellular
- Vacuole

**Time Frame**

This activity will require approximately 12 days. Plan to provide 12 to 14 hours of class time.
Instructional Plan

Getting Started

CCRS Performance Expectations

Cross-Disciplinary Standards:

I. Key Cognitive Skills

D.1. Self-monitor learning needs and seek assistance when needed.

D.2. Use study habits necessary to manage academic pursuits and requirements.

E.1. Work Independently.

Science Standard:

VI. Biology

A.1. Describe the structure and function of major sub-cellular organelles.

Learning Objective

Students will:

- Understand the role of sub-cellular organelles in the structural hierarchy of life.

Procedure

1. Discuss the hierarchy of life so students will be familiar with the structural level of organelles within the scope of the biosphere. Then ask students to write the following terms on index cards and arrange the cards in order from the largest structure to the smallest:

   Biosphere, Biome, Cell, Cell organelle, Community, Ecosystem, Organism, Organ system, Organ, Population, Tissue

2. Discuss the need to understand sub-cellular organelles. Explain that an understanding of organelles has led to advancements in medicine. For example, studying the structure of cell membrane transport proteins has led to a better understanding of cell signaling and insulin-related glucose uptake.

3. Distribute the Student Notes. Describe the assignment. Share the scoring guide and timeline with students. Clearly establish which tasks are to be completed during class and which components are to be completed outside of class. Provide time for students to develop a task list and completion time line.
Investigating

**CCRS Performance Expectations**

Cross-Disciplinary Standards:

I. Key Cognitive Skills
   
   B.2. Construct well-reasoned arguments to explain phenomena, validate conjectures, or support positions.
   
   D.1. Self-monitor learning needs and seek assistance when needed.
   
   D.2. Use study habits necessary to manage academic pursuits and requirements.


   D.4. Persevere to complete and master tasks.

   E.1. Work Independently.

   F.1. Attribute ideas and information to source materials and people.

   F.4. Understand and adhere to ethical codes of conduct.

II. Foundational Skills

   A.4. Identify the key information and supporting details.

   C.5. Synthesize and organize information effectively.

   E.1. Use technology to gather information.

Science Standard:

VI. Biology

   A.1. Describe the structure and function of major sub-cellular organelles.

**Learning Objectives**

Students will:

- Develop diagrams and descriptions of cell organelles.

- Demonstrate an understanding of cell organelle function by developing an analogy to an existing system such as a city, school, or family.

**Procedure**

1. Distribute the *Information Summary* handout. Explain that students should use these pages to record the information they gather. Remind students that academic integrity is important. They should document all sources used. Give examples of citing different types of references. Make sure students understand the use of public domain images and how to locate them and cite sources.
2. Distribute the list you have prepared of possible resources and references to be used for research.

3. Monitor students’ work, periodically checking for accuracy and redirecting searches as needed.

4. When students have begun their research, share a sample analogy. Liken the cell to a city. The nucleus, which is the control center of a cell, can be compared to city hall. The city’s waste disposal team would be analogous to lysosomes, the power plant analogous to mitochondria, and the post office analogous to the Golgi apparatus. Additional ideas for analogies include a school system, hospital, shopping center, factory, amusement park, and airport.

5. Before students submit their completed Information Summary handouts, they should each make a copy for use as they write their narratives.

**Drawing Conclusions**

**CCRS Performance Expectations**

Cross-Disciplinary Standards:

I. Key Cognitive Skills
   D.1. Self-monitor learning needs and seek assistance when needed.
   D.2. Use study habits necessary to manage academic pursuits and requirements.
   D.4. Persevere to complete and master tasks.
   E.1. Work Independently.
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II. Foundational Skills
   A.4. Identify the key information and supporting details.
   B.1. Write clearly and coherently using standard writing conventions.
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   C.6. Design and present an effective product.
   C.7. Integrate source material.
   C.8. Present final product.
   E.3. Use technology to communicate and display findings in a clear and coherent manner.
Science Standard:

VI. Biology

A.1. Describe the structure and function of major sub-cellular organelles.

**Learning Objectives**

Students will:

- Compile cell organelle research into a digital slideshow.
- Use original digital images or public domain images to illustrate the structure of cell organelles.
- Write a narrative description of cell organelles, using an analogy to structure the narrative.

**Procedure**

1. Show students the sample digital slide you have prepared. Note how an analogy has been incorporated in the slide. Let students know they will prepare slides to explain the functions of six of the twelve cell organelles they have researched.

2. Emphasize the need to plan the contents of a slideshow. Explain the purpose and expectations for the table of contents. Then explain the purpose of the introductory slide: Give the example of students using the titles *Cell City* and *Cytoville* in the introductory slide.

3. Encourage students to be creative in the design of their slideshows while including all information indicated on the rubric.

4. Students should peer review their first three sides: (1) introduction, (2) table of contents, (3) first organelle. Students should note any items that have been left out or that need more development.

5. Provide approximately four days for students to complete their slideshows. Instruct students to incorporate the peer-review feedback as they work.

6. When the slide shows are completed, students should print their slides or save them to a thumb drive to submit.

7. Explain to students that the descriptive narratives they will now write will convey their research findings in a different format, and will also require citations. Provide time for students to draft their narratives.

8. Finally, students should submit their narratives and present their slideshows to the class.
Scaffolding/Instructional Support

The goal of scaffolding is to remove support gradually to encourage student success, independence, and self-management. The suggestions will be used by instructors to meet diverse student needs. Some examples of scaffolding that could apply to this assignment include:

• Students who have under-developed time management skills may need more narrow due dates with smaller sized interim products. Review their personal timelines to make sure they have set smaller windows of work time. For example, some may need to submit their projects one page or slide at a time.

• Students with reduced work IEPs may be assigned fewer than six organelles.

• Many learners will need tangible reminders of due dates. For example, interim product due dates could be continuously posted in the classroom.

• Language-limited learners may need to be partnered during the research portion of the project.

• Samples of a descriptive narrative may help students struggling with the written component of the assignment.
Solutions

The solutions provided in this section are intended to clarify the problem for instructors. These solutions may not represent all possible strategies for approaching the problem or all possible solutions. It should be used for reference only.

Students will likely produce presentations in different mediums. Creativity is limited only by required contents.

Students should adhere to given time requirement for their presentations. Remind students to avoid using copyrighted images in their slideshows.

Descriptive narratives should include all information gathered in the Information Summary handout (with the exception of the sketches) and be properly cited.
Cell Organelle Slideshow

Introduction

The cell is the basic functional unit of life on our planet. The small and seemingly simple cell of a plant or animal is actually a complex system of smaller components called organelles. Each organelle has a unique function and specific structure.

In this activity you will develop your understanding of the features of sub-cellular organelles. You will explore the structure of major organelles and become familiar with the role that each organelle plays in the functioning of a normal cell. You will showcase your understanding of sub-cellular organelles using a digital slideshow and by writing a description based on your research.

Directions

Getting Started

1. Prepare a set of structural hierarchy cards by writing each of the following terms on the face of an index card: biome, biosphere, cell, cell organelle, community ecosystem, organ, organism, organ system, population, and tissue. In class, use your prior knowledge to discuss and sequence the structural hierarchy cards.

2. Listen as your instructor describes each component of the project. Review the project rubric and ask for needed clarifications.

3. Develop a personal time line that identifies the various tasks you will need to complete for this project. On your time line, note how you will schedule your time outside of class. Your timeline should include personal target due dates as well as official due dates for the various project components.

Investigating

1. Your instructor will provide a list of 12 organelles. Write their names on the Information Summary handout.

2. Using at least three sources from the list your teacher provides, research the structure and function of each sub-cellular organelle. Record this information on the handout. Save any public domain images you may wish to use.

3. Record the references and resources used during your research. These will be included in a bibliography for your presentation and narrative.

4. The class will discuss analogies for the cell and cell organelles. Decide upon
an analogy to use for your project. For each organelle, write a description that fits the analogy.

**Drawing Conclusions**

1. Design an introductory slide that includes your name, course title, date, and a title that fits your analogy.

2. Select six organelles to include in your slideshow. Create the table of contents slide. Carefully consider the order in which you will present the organelles in your slideshow.

3. Prepare a slide for the first organelle in your presentation.

4. With a partner, peer review your first three slides. You will use the feedback you receive to revise and complete your presentation.

5. Complete your slideshow, including an introductory slide, table of contents, six organelle slides, and a bibliography. The bibliography should include all important references, and use APA citation style.

6. Use the analogy you have chosen to write a descriptive narrative of the six organelles in your slide show. Again you will summarize their structures and functions. Be sure to cite properly.

7. Assemble your slideshow, including an introductory slide, table of contents, six organelle slides, and bibliography.

8. Present your slideshow to the class.

9. Submit your timeline and narrative.