

## Cell-to-Cell Unit Plan

**Title:** Cell-to-Cell

**Description:** Students assume the roles of medical researchers and use their understanding of groundbreaking cell biology research to trace the origins of diseases back to the cellular level.

### At a Glance

**Grade Level:** 9

**Subject sort (for Web site index):** Science

**Subject:** Biology

**Topics:** Functions and Structures of Cell Organelles (Cell Parts), Differences among Cells, Interconnection between Cell Function and Health of Organisms

**Higher-Order Thinking Skills:** Investigation, Synthesis

**Key Learnings:** Cell Structure and Function, Levels of Complexity of Life, Cellular Processes, Cell Cycle, Mitosis, Meiosis, Differentiation, Replication, Cell Research and Medicine

**Time Needed:** 3 weeks, 45-minute lessons, 4 times per week

**Background:** [From the Classroom in Texas, United States](#)

### Unit Summary

Cells are the basic structural and functional units of life. This unit explores the vast array and functions of cells in living organisms, investigates how different types of cells interact, introduces current research, and addresses ethical concerns in the field of cell biology. Students are also introduced to various types of cells and their parts. Students design presentations that describe one cell part and show their presentations to the class. Then they assume the roles of medical researchers and create presentations supported by newsletters that highlight diseases, tracing the origins of diseases back to the cellular level.

### Curriculum-Framing Questions

- **Essential Question**  
What's the connection?
- **Unit Questions**  
What can cells tell us about life?  
Where is cell biology research headed?
- **Content Questions**  
How do prokaryotic and eukaryotic cells differ?  
How do cells work together to form functioning tissue?

### Assessment Processes

View how a variety of student-centered [assessments](#) are used in the Cell-to-Cell Unit Plan. These assessments help students and teachers set goals; monitor student progress; provide feedback; assess thinking, processes, performances, and products; and reflect on learning throughout the learning cycle.

### Instructional Procedures

#### Assessing Background Knowledge and Establishing a Foundation Day 1

Introduce the topic of cell biology with the following warm-up activity (oral or written):

The word *cell* is used in many contexts. How many can you think of? Now, consider the various uses of the word *cell*, and, based on your knowledge of the biological definition of cells, what does the word *cell* mean? (Answers may relate to compartmentalization or holding separately, with examples such as a jail cell, monk's cell, terrorist cell, fuel cell, cell battery, or cellular phone.)

Pose the Essential Question, *What's the connection?* Hold a class discussion focused on this question and how it relates to their responses to the warm-up activity. Next, brainstorm questions about the subject of cells. Assemble a list of the brainstormed questions. The student-generated questions serve as the basis for some of the later discussion and research.

Present the [syllabus](#) and discuss unit expectations.

Divide the class into groups of three. Have each group choose two or three questions to research and present to the class the next day. A variety of print and electronic resources should be made available for this assignment.

## Day 2

Ask each group to present their research on basic questions about cells. Instruct students to take notes to help with later projects in the unit. Lead a class discussion to summarize students' findings, and make clarifications and additions as needed. Have students think about and discuss briefly their thoughts on the Unit Question, *What can cells tell us about life?* Students investigate this further in the upcoming lessons.

## Day 3

In advance of this lesson, gather pictorial representations of various cell types. Introduce the following basic differences between plant cells and animal cells:

- Plant cells have cell walls, chloroplasts containing chlorophyll, other plastids that help store food, and a large vacuole.
- Animal cells have no cell walls, and their shape is less regular. Most animal cells have numerous small vacuoles that help in their storage of nutrients and waste products.

Introduce the differences between prokaryotic cells (such as bacteria, with no organized nucleus or membrane-bound organelles) and eukaryotic cells (most plant and animal cells, having an organized nucleus and membrane-bound organelles). This [Online Tutorial](#)\* offers an explanation of prokaryotes, eukaryotes, and viruses.

Project images of cell samples. Help students discriminate between plant and animal cells, and prokaryotic and eukaryotic cells.

After the discussion, assign a two-minute paper in which students summarize the distinctions between plant and animal cells, and prokaryotic and eukaryotic cells. Ask students to also answer the Unit Question, *What can cells tell us about life?* in their own words. Collect and review the summarizations to monitor student learning thus far and direct teaching. In addition, a homework assignment could include drawing and labeling diagrams of the cells.

Continue introducing other distinctive cell types, such as gametes and nerve cells.

## Introduction of Major Concepts and Exploration Days 4, 5, and 6

Begin each session with a "Question of the Day" discussion, using the students' brainstormed questions from Day 1 or daily science reports from newspapers (such as [New York Times](#)\* or [USA Today](#)\*) or magazines (such as [Scientific American](#)\* or [Discover](#)\*). Focus on the brainstormed questions that illustrate connections and relationships of organelles to cells, cells to other cells, cells to tissues, and cells to the health of organisms. Encourage thinking on different levels—evaluative, explanatory, opinion, historical context, and ethics.

Have students view a [Cell Camera](#)\* to explore the size of cells; study the structure of plant, animal, and bacterial cells; see interactive animations of cell cycles; and view cell division in cancer cells and bacteria. Have students review an [Online Tutorial](#)\* to learn about the cell cycle and the processes of mitosis and meiosis as well as see an explanation of prokaryotes, eukaryotes, and viruses.

Assess knowledge of cell structure and function with the [CELLS alive! Online Quiz](#)\*. Ask students to focus on the connection between a cell's structure and its function.

Distribute a quiz covering the content addressed to date.

## Research and Presentation—Assignment #1: Organelles Days 7 and 8

Assign each student one of the following cell organelles to study:

- Cell Membrane and Cell Wall
- Cytoplasm and Cytoskeleton
- Endoplasmic Reticulum and Ribosomes
- Golgi Apparatus and Lysosomes
- Mitochondria
- Nucleus
- Vacuoles

Have students study their assigned cell parts, using the [assignments checklist](#) as a guide, and prepare a presentation for the class. Each presentation should address the following questions:

- *In what type of cell is your organelle found?*
- *What is the organelle's composition or structure? (a diagram might be helpful)*
- *What is your organelle's function and why is it important?*
- *What are the mechanisms of the organelle's function? How is it regulated?*
- *What is the connection between the organelle's function and the cell's function, and what would happen if a cell did not have this organelle?*
- *What sources did you use to get pictures and unique information?*

Show the sample [multimedia presentation](#). Give students two days to research their organelles and develop their multimedia presentations.

## Day 9

Have students present their research, and, as they listen to presentations, have students complete the [cell structure and function](#) chart.

Have students assess other group members' participation.

Assess students' oral presentations and multimedia presentations using the [rubric](#).

## **Research, Application of Knowledge, and Presentation—Assignment #2: Diseases**

### **Days 10, 11, and 12**

In this assignment, students investigate the Unit Questions, *Where is cell biology research headed?* and *What can cells tell us about life?*

Brainstorm a list of medical conditions and illnesses (such as the common cold, HIV, cystic fibrosis, and so forth), and have each group choose a different one to study. Following the criteria listed on the [assignments checklist](#), students assume the roles of medical researchers or reporters/newspaper writers, investigate the health problem, and attempt to trace the disease process to the cellular level. Using the information obtained in researching the organelles and their background of cells, students make correlations among diseases and disorders, cellular mutations or abnormalities, and abnormalities of organelles. Each group completes a diagram showing how the expression of the disease occurs through infection, genetic, or environmental causes. Groups study current research relating to the disease, and synthesize their findings in a news article. Finally, each group member writes an essay expressing personal beliefs about ethical questions that arose during their study. These parts are combined in a presentation and are reported in a [newsletter](#).

Hold a class symposium with each team presenting its research and moderating a class discussion. Finally, revisit the Essential Question, *What's the connection?* Ask students to reevaluate this question based on their new knowledge of cells.

Assess students using the [presentation scoring guide](#) and [newsletter scoring guide](#).

### **Prerequisite Skills**

- Basic computer and research skills
- Basic software knowledge, including slideshow, multimedia, desktop publishing, word processing, and image processing

### **Differentiated Instruction**

#### **Resource Student**

- Assign specific, more precise tasks in team productions, focusing on individual strengths of the student, such as drawing for the newsletter, modeling a cell, acting as moderator for symposium, and so forth
- Provide a checklist that breaks down individual tasks into component parts
- Allow additional time for completing assignments and working on online tutorials
- Allow the student to complete exams orally
- Enable the student to use voice recognition software if the student is visually impaired
- Help the student use outlining techniques for creating a multimedia presentation
- Request assistance of resource aides

#### **Gifted Student**

- Allow the student to act as the news herald for the class by keeping a log of breaking science news and synthesizing the content for the class
- Encourage the student to interview experts online or in person
- Have the student log daily related science news articles and reflect on the articles' course-related topics
- Assign a specific technology to investigate and report (for example, the student could study the [Scanning Electron Microscope](#)\* and present the subject to the class in a mini-lesson; the student could also study and compare other technologies that are revolutionizing the study of life science and medicine, such as transmission electron microscopes, acoustic microscopes, scanning tunneling microscopes, magnetic resonance and other imaging technologies, computerized axial tomography and ultrasound)

### English Language Learner

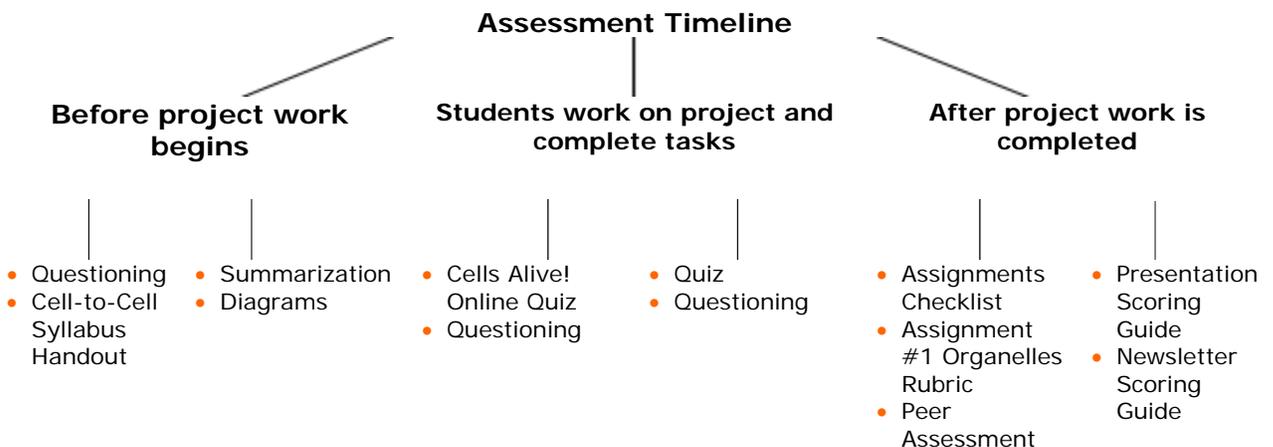
- Ask the ELL support teacher to help the student develop a glossary of terms in both English and the student's first language
- Enlist the help of bilingual students to help with translating and interpreting concepts
- Allow for visual representations to reduce the language load
- Write vocabulary terms on a chart as they are introduced
- Allow the student to write material in the student's first language for later translation

### Credits

Josh Eason participated in the Intel® Teach Program, which resulted in this idea for a classroom project. A team of teachers expanded the plan into the example you see here.

### THINGS YOU NEED (highlight box)

#### Assessment Plan



Questioning is used at the beginning of the unit to assess prior knowledge as well as throughout the unit to promote discussion and encourage higher-order thinking

skills. The [syllabus](#) provides guidelines for students as they develop their project and allows students to self-monitor their progress throughout the project. Understanding of content can be monitored with the papers summarizing distinctions between plant and animal cells, and prokaryotic and eukaryotic cells as well as labeled diagrams of cells. Students conduct self-assessments of their understanding of cell structure and function through the [CELLS alive! online quiz](#)\*. A teacher-generated quiz assesses students on all content addressed to date. Students monitor their individual work with the [assignments checklist](#) and the [rubric](#). The same rubric is used to assess the students' slideshow presentations. The [group presentation scoring guide](#) is used to peer-assess the presentations as well as for final assessment at the end of the project. After project work is complete, the [newsletter scoring guide](#) is used to assess student products.

## Targeted Content Standards and Benchmarks

### Targeted Arizona Content Standards and Benchmarks

#### Science: Strand 4: Life Science

- Compare the form and function of prokaryotic and eukaryotic cells and their cellular components
- Describe the purposes and processes of cellular reproduction
- Describe the levels of organization of living things from cells, through tissues, organs, organ systems, organisms, populations, and communities to ecosystems

#### Technology: Standard 1—Grade 9-12

- Use organizational features of electronic text, such as bulletin boards, database keyword searches, and e-mail addresses to locate information and conduct research
- Read and follow directions to complete a technology-based task

#### Technology: Standard 2—Grade 9-12

- Plan, produce, and present an effective multimedia presentation using visual media, including cartoons, computer images, charts, photographs, maps and tables, to communicate the intended purpose to the audience
- Use appropriate tools for gathering, interpreting, and presenting data
- Select and use appropriate technologies to gather, process, and analyze data and to report information related to an investigation

### Student Objectives

Students will be able to:

- Distinguish between prokaryotic and eukaryotic cells
- Distinguish between plant and animal cells
- Describe and identify the structure and function of various organelles, including mitochondria, nucleus, cell membrane and cell wall, endoplasmic reticulum and ribosomes, golgi apparatus and lysosomes, cytoplasm and cytoskeleton, and vacuoles
- Determine interrelationships between organelle functions and cell function
- Identify different cell types, such as gametes, nerve cells, and so forth
- Connect functions of organelles in cells to organisms' overall health
- Describe the cell cycle
- Link cellular mutations or malfunctions and diseases

## Technology and Resources:

### Internet Resources

- The Biology Project: Cell Biology  
[www.biology.arizona.edu/cell\\_bio/cell\\_bio.html](http://www.biology.arizona.edu/cell_bio/cell_bio.html)\*  
Information about the cell cycle and the processes of mitosis and meiosis, and an explanation of prokaryotes, eukaryotes, and viruses
- New York Times  
[www.nytimes.com](http://www.nytimes.com)\*  
Latest information on science developments and research
- Scientific American  
[www.sciam.com](http://www.sciam.com)\*  
Latest information on science developments and research
- Discover  
[www.discover.com](http://www.discover.com)\*  
Latest information on science developments and research
- CELLS alive!  
[www.cellsalive.com/quiz1.htm](http://www.cellsalive.com/quiz1.htm)\*  
Information about the size of cells; the structure of plant, animal and bacterial cells; cell cycles (animated); cell division in cancer cells; and a self-assessment quiz on organelles
- Museum of Science  
[www.mos.org/sln/sem/intro.html](http://www.mos.org/sln/sem/intro.html)\*  
Information and pictures of the scanning electron microscope

### Technology—Hardware

- Computers to conduct research and complete assignments
- Printer to print information and assignments
- Microscopes to view cells
- Projection system to display presentations to the class

### Technology—Software

- Desktop publishing, word processing, and multimedia presentation software to create presentations and support materials, and to complete tests and cell structure and function charts
- Internet connectivity to conduct research on organelles and diseases