Grade 7
Science
Unit 2: Plant and Animal Cells

Time Frame: Approximately two weeks

Unit Description

This unit focuses on comparing the basic structures and functions of different types of cells, with an emphasis on comparing the cell structures of plants and animals.

Student Understandings

A basic knowledge of cellular structure and function is essential to the understanding of both plant and animal cells. Students are expected to effectively use a compound microscope to view cells. They will create presentations on the development of the modern cell theory, identify basic cell structures, and describe their functions in both plant and animal cells.

Guiding Questions

1. Can students explain why cells are called life's building blocks?
2. Can students describe the cell as a three-dimensional object?
3. Can students compare and contrast a plant cell and an animal cell?
4. Can students locate and describe the function of cell organelles within the cell?
5. Can students describe how technology has played an increasingly important role in our knowledge of cell structures?

Unit 2 Grade-Level Expectations (GLEs)

GLE #	GLE Text and Benchmarks
Science as Inquiry	
Note: The following Science as Inquiry GLEs are embedded in the suggested activities for this unit. Other activities incorporated by teachers may result in additional SI GLEs being addressed during instruction on the Plant and Animal Cells unit.	
1.	Generate testable questions about objects, organisms, and events that can be answered through scientific investigation (SI-M-A1)
3.	Use a variety of sources to answer questions (SI-M-A1)
6.	Select and use appropriate equipment, technology, tools, and metric system units of measurement to make observations (SI-M-A3)
7.	Record observations using methods that complement investigations (e.g., journals, tables, charts) (SI-M-A3)

GLE #	GLE Text and Benchmarks
15.	Identify and explain the limitations of models used to represent the natural world (SI-M-A5)
19.	Communicate ideas in a variety of ways (e.g., symbols, illustrations, graphs, charts, spreadsheets, concept maps, oral and written reports, equations) (SI-M-A7)
21.	Distinguish between *observations* and *inferences* (SI-M-A7)
25.	Compare and critique scientific investigations (SI-M-B1)
29.	Explain how technology can expand the senses and contribute to the increase and/or modification of scientific knowledge (SI-M-B3)
30.	Describe why all questions cannot be answered with present technologies (SI-M-B3)
33.	Evaluate models, identify problems in design, and make recommendations for improvement (SI-M-B4)
35.	Explain how skepticism about accepted scientific explanations (i.e. hypotheses and theories) leads to new understanding (SI-M-B5)
39.	Identify areas in which technology has changed human lives (e.g., transportation, communication, geographic information systems, DNA, fingerprinting) (SI-M-B7)
40.	Evaluate the impact of research on scientific thought, society, and the environment (SI-M-B7)
Life Science	
2.	Compare the basic structures and function of different types of cells (LS-M-A1)
4.	Compare functions of plant and animal cell structures (i.e., organelles) (LS-M-A2)

Sample Activities

Activity 1: Microscopes—a Closer Look (SI GLEs: 6, 7, 19, 29, 30, 39, 40)

Materials List**:** microscope, microscope slides, cover slips, water, pipette, prepared plant and animal cell slides, cover slips, newsprint, scissors, Internet access, resource information, tradebooks, science learning logs

Safety note: Caution students about safe handling of glass microscope slides.

Allow students to identify and describe the parts of the microscope, discussing the proper handling and care of both the microscope and microscope slides. Provide opportunities for students to practice using a microscope until they become proficient in the use of this laboratory tool. Newsprint can be cut out, placed on a slide with a drop of water and a cover slip and observed using 40x and 100x. Once students are comfortable with this practice, provide students with prepared slides of both plant and animal cells and allow them to practice focusing the slides correctly. They should then sketch and record what they observe in their science *learning logs*.

(view literacy strategy descriptions) Science learning logs are booklets where students can record scientific observations, questions, drawings, and other information pertaining to activities. (If individual microscopes are not available, technology can be substituted to allow viewing by the entire class.) Note: A more thorough investigation of plant and animal cell slides will be done in Activity 3.

Engage students in a discussion of what impact the microscope has had on the science community. Following the discussion, students will research discoveries made with light microscopes, beginning with Robert Hooke (1665). Using textbooks, library resources, trade books, or Internet sites such as http://www.unl.edu/CMRAcfem/em.htm,students will research types of microscopes including the stereomicroscope, compound light, bright/dark field microscope, fluorescence microscope, TEM, SEM, and phase-contrast electronic microscopes. This information will be used to compile a timeline. From the researched information, students should also select one major medical discovery in which the use of a microscope was important and describe its impact on society. Question students about scientific professions that they are aware of that require the use of microscopes such as research scientists, oncologists, microbiologists, stem cell researchers, and crime scene investigators. Discuss the possible type of microscope used in each profession listed and how it might be used. Have students generate a list of limitations of each of the current microscopes being used and why all questions cannot be answered even with present technological advances in microscopy.

Activity 2: Cell Theory (SI GLEs: 19, 25, 29, 35)

Materials List: cell theory resource information, textbooks, trade books, Internet access, science news journals (optional), technology to create an electronic presentation or poster board and markers

Robert Hooke (1665) is noted as the first person to observe cells. He actually viewed the outer walls of dead cork cells rather than the living cells. Cork comes from the light, thick outer bark of the oak tree. The cork he viewed reminded him of little boxes, which he named cells. His work was an important step into the study of cells. However, the work of other scientists also contributed to the development of what is known as the "modern cell theory."

Place students in groups of four and provide them with access to background information about each scientist and their work that contributed to the development of the cell theory. Students should compare and critique each of these earlier theories and explain how skepticism about each theory helped to further new understanding. Write the modern cell theory on the board and instruct students to determine what role their assigned scientists played in its development.

Using information provided, students should create a *RAFT* writing assignment (view literacy strategy descriptions). *RAFT* writing gives students the freedom to project themselves into unique roles and look at content from unique perspectives. From these roles and perspectives, *RAFT* writing should be used to explain processes or describe a point of view. This kind of writing assignment is intended to be creative and informative.
Ask students to work in pairs to write the following *RAFT*:

R-(Role of the writer) - scientist
A-(audience to whom or what the *RAFT* is being written) - reporters
F-(Form the writing will take, as in a letter, song, brochure, etc.) - letter or news conference
T-(Topic or subject focus of the writing) - the topic focus should discuss a ground-breaking discovery made by their assigned scientist which lead to the development and acceptance of the modern cell theory.

If technology is available, students will create their *RAFT* as an electronic presentation. Where technology is not available, students will present this information using a visual display.

As a concluding activity, students should explain how technology can expand the senses and contribute to the increase and modification of scientific knowledge by discussing current scientific discoveries. Articles that profile such discoveries can be found in daily newspapers, student science news papers, and Internet sites such as Science News for Kids. One such article, Color Changing Bugs, can be found at http://www.sciencenewsforkids.org/articles/20070905/Note2.asp.

Activity 3: Differentiating between a Plant and an Animal Cell (SI GLEs: 6, 7, 19; LS GLEs: 2, 4)

Materials List: colored plant and animal cell transparencies, microscopes, prepared animal and plant cell slides, onion skin, microscope slides, cover slips, water, pipette, aquarium plant such as Elodea, technology to create a cell brochure, markers, colored pencils, science learning logs

Safety note: Identify and discuss appropriate safety rules and procedures while handling microscopes and living specimens.

Activate student prior knowledge about plant and animal cells by asking leading questions such as What are cells? How are cells important to living organisms? Name some organelles found in living cells. What are the major differences between plant and animal cells?

Display colored transparencies or pictures of an animal cell and a plant cell. Provide students with copies to label and then discuss the size, shape, and location of the organelles. Explain to students that cell pictures usually show the organelles in color, although within the living cell they are generally colorless with the exception of the plastids. Revisit *photosynthesis* (Activity 1) and introduce the term *chloroplasts*. Explain that the chloroplast is a type of plastid that contains chlorophyll and is important during photosynthesis.

Provide student groups with prepared microscope slides of animal and plant cells, such as those used in Activity 1. Without identifying the cell type, allow students to view slides and sketch and record detailed observations of each, particularly noting the differences in their science *learning logs (*view literacy strategy descriptions). Allow students to infer the cell types, explaining how their decision was made. As a class, discuss the observable differences seen under the microscope and how they were used to identify the cell type.

If materials are available, students can prepare their own plant cell slides for viewing. Review all safety rules and procedures while preparing cell slides. Procedures on how to prepare a plant cell microscope slide can be obtained online at http://www.middleschoolscience.com/microscope.pdf. Good plant cell specimens can be obtained from the skin of onions or small plant leaves, such as the aquarium plant, Elodea, which is available at most pet stores or from scientific supply companies.

As a review of the lesson, instruct students to create a cell brochure from their observations, using the computer, if available, or construction paper. (Students can fold the paper as a brochure; those using computers can create the document as a three panel brochure and insert cell pictures from http://www.cellsalive.com/cells/3dcell.htm.) Students are to label one panel Plant Cell and the other panel Animal Cell and draw a picture under each label representing the proper cell and its components. On the inside panel students should list the parts of each cell, and list the major differences between the animal and plant cell in the center panel. For classes with limited access to microscopes, have students visit http://www.cellsalive.com/cells/3dcell.htm to observe and create drawings of both types of cells. Excellent diagrams can also be found at http://waynesword.palomar.edu.

Activity 4: Who's in the Pond? (SI GLEs: 1, 6, 7, 21; LS GLEs: 2)

Materials List: access to pond or aquarium water, microscope, microscope slides, cover slips, pipette, protective gloves, group copy of Who's in the Pond BLM

*Safety note***:** *Identify all safety rules and procedures and discuss sanitary issues associated with handling living organisms (e.g., wearing gloves, hand washing after the procedure, careful handling to prevent breakage of microscope slides, etc.).*

While working in groups of three, students will complete the Who's in the Pond KWL BLM *graphic organizer* (view literacy strategy descriptions) describing what they know about organisms within a pond ecosystem, what they want to know, and at the conclusion of the activity, what they have learned. A graphic organizer is a way for students to describe what they have learned about a topic in a written organized format. The KWL *graphic organizer* may include things such as a general description of a pond and the types of organisms that make up a pond.

Discuss the living (biotic) components of a pond. Have students describe macroscopic and microscopic organisms and infer how they relate to the pond. Ask students how can something so small as a single-celled organism be so vital to other living things? Microscopic living organisms are important in oxygen production during photosynthesis and are the first link in many food chains.

Obtain a sample of pond water. Note: Be sure that the water sample comes from a pond and not a ditch that might contain sewage, etc. If a pond is unavailable, fish aquarium water can be used. Allow students to make visual observations of the water, while clarifying the difference between observations an inference. Provide students with simple pictures to use as practice for observing

and inferring. (Simple pictures from a story can be used).Discuss the observable components of the picture and allow students to infer what should happen next, based on their observations.

Review safety procedures with students in addition to the proper way to prepare a wet mount slide (see details in Activity 3). Instruct students to create their own wet mount slide using a drop of the pond water. They should sketch, record, and classify observations, describing patterns in locomotion and physical features such as color, shape, or appendages of any organisms observed in their science *learning log (*view literacy strategy descriptions). Based on their observations, instruct students to identify the organisms that they think will photosynthesize. Students should relate the color (green) of the organism to the ability to photosynthesize. Review the concept of *photosynthesis*, if necessary, as discussed in Unit 1. Note: Some single celled organisms, such as diatoms, may contain other pigments which can mask the green chlorophyll.

As a conclusion, review the Who's in the Pond KLW *graphic organizer* and discuss what information students have learned about the differences in plant and animal cells.

Activity 5: Cell Structures (SI GLEs: 3, 15; LS GLEs: 2, 4)

Materials List: newsprint paper or other large paper, Internet access

Review the basic structures of animal and plant cells and their visible differences. Refer students to the animal cell organelles picture on the *Cells Alive* Web site at http://www.cellsalive.com/ or the interactive *Cell Page* at http://sun.menloschool.org/~cweaver/cells. Where technology is unavailable, transparencies or diagrams of the cell may be used to examine organelles.

Now that students have identified the visible differences between plant and animal cells as in Activity 3, they should describe the function of the organelles. Have students click on the organelles in the pictures/diagrams to see an enlarged view and description of each. Focus on the main concept that a single cell has many parts and each part has a job to do. As they view the animal cell, emphasize that this is a composite or model of an animal cell and that it doesn't represent any cell in particular. Repeat this process for the plant cell and the organelles pictured at the Web site. Ask students to identify and explain limitations of these models of cells.

Ask students to compare the other types of cells, such as nerve cells, red and white blood cells, skin cells, and both involuntary and voluntary muscle cells. Discuss the form and function of these cells as they compare to one another.

Explain that cells can be classified into two major groups prokaryotic and eukaryotic, and provide students with a diagram or illustration of each type. Lead students to develop a definition of each cell type and to explain how each type carries out life's basic functions.

If technology is not available, this activity can be completed by creating paper drawings of the cells and their organelles. Play the game Who am I, by enlarging pictures of each type of cell and coloring one organelle to focus on. Place a description of the organelle on the back of the picture.

While displaying the picture, read the description and ask students to determine which organelle is being described.

The teacher may wish to configure this activity as a Web quest. Templates and instructions can be found at http://www.educationworld.com/a_tech/tech/tech011.shtml.

Provide students with a copy of an article that reports on current scientific discoveries that relate to plant or animal cells. (For an example, see the article, Single-Celled Transformers: Marine Phytoplankton Changes Form to Protect Itself, at http://www.sciencedaily.com/releases/2007/06/070615133823.htm. To ensure that they take responsibility for constructing meaning from the text, students should be introduced to *QtA or* Questioning the Author (view literacy strategy descriptions). This process can be done by displaying a chart of questions that students are expected to ask as they read. *QtA* involves the teacher and the class in a collaborative process of building understanding during reading. As students read a section of text, model for them the question-asking and answering process, and invite them to do the same. Generate questions that focus on the article such as the following:

- Can all phytoplankton transform, or is there a certain species?
- What provides the ability to transform?
- What does the phytoplankton transform into?
- How is the transformation size different from the original size?
- How long does the transformation take?
- What promotes the transformation?
- By transforming, how is this beneficial to the species?

Allow students to add additional questions.
After reading the text, discuss answers that students determined during the reading. Identify key concepts and discuss how they relate to plant or animal cells.

Activity 6: Cell Walk-Through (SI GLEs: 15, 19, 33; LS GLEs: 2, 4)

Materials List: Internet access, textbooks, trade books, large drawing paper, markers, colored pencils, cardboard, other materials needed to create 3-dimensional cell parts

To demonstrate understanding, have students create large 3-dimensional classroom models of both a plant and animal cell that other students can walk through. Divide students into two groups, i.e., the plant cell and the animal cell. Determine how many cell parts will be needed to build a plant and/or animal cell and assign one to each student in each group. Allow students to use reference materials to create a large model of their particular cell part. Discuss the use and identify the limitations of models in science. Explain that scientist often use models to represent concepts and present information. Students should determine the boundary for the cell and place all model parts, with labels within it.

Upon completion, students from one group will walk through the other group's model, while the student that created the model cell part explains its function. Students should also create a *graphic organizer* (view literacy strategy descriptions) such as a concept map, flow chart, or Venn diagram to compare the similarities and differences between parts in the two types of cells.

Following the walk through, have students explain why some cell parts are particular to one type of cell or the other. Ask students to identify which cell parts were the most difficult to model and why. Have students identify limitations of their models. Allow students from one group to suggest ways to improve specific aspects of the other group's model.

Activity 7: Cell Model (SI GLEs: 6, 7, 15, 19, 33; LS GLE: 2, 4)

Materials List**:** box of yellow gelatin (1 small box per two group); Knox gelatin (one envelope per group); quart-sized plastic bags; twist ties; water; heat source; mixing bowls; spoons; disposable plastic sandwich containers; access to refrigerator; materials to create cell structures; e.g., canned or fresh fruit, pepper, yarn, pencil shavings, plastic bubble packing, beads, buttons, pasta of different colors and shapes, pipe cleaner, etc.; access to refrigeration; What's In My Cell? BLM (one per student)

Follow the instructions on how to create the cell model from the activity at this website http://school.discoveryeducation.com/lessonplans/programs/cello/ . Refrigerate the models over night to set. Provide students with a copy of the What's In My Cell BLM *word grid* (view literacy strategy descriptions) and direct them to complete it. Building a word grid involves placing important information as it relates in columns and rows.

The next day, have students study the two cell models and note the structural differences between plant cells and animal cells. Have students provide written responses to the following questions:

- What are the shapes of the two cells?
- What effect does the cell wall have on the plant cell?
- Why do you think plant cells have sturdy walls? How does this help them survive?
- How does the cell wall influence the structure of the plant itself?
- Why don't animal cells need cell walls?

Ask students how they might form a *model* of a plant tissue. (stack a few of the plant cells on top of one another and/or side by side). Have the students compare the structural and overall shape differences. This can be done with individual cells or after stacking them to form tissues. Have students create diagrams of their models.

Conclude the class discussion with questions regarding models and technological advances. Ask such questions as, why do we often depend on models? Why are models useful when discussing cells? What are some limitations of models in general? How has technology played an increasingly important role in our knowledge of cell structures? How is this model like a plant cell? How is it not like a plant cell?

Sample Assessments

General Guidelines

Assessment will be based on teacher observation/checklist notes of student participation in unit activities, the extent of successful accomplishment of tasks, and the degree of accuracy of oral and written descriptions/responses. Journal entries provide reflective assessment of class discussions and laboratory experiences. Performance-based assessment should be used to evaluate inquiry and laboratory skills. All student-generated work, such as drawings, data collection charts, models, etc., may be incorporated into a portfolio assessment system.

- Students should be monitored throughout the work on all activities.
- All student-developed products should be evaluated as the unit continues.
- When possible, students should assist in developing any rubrics that will be used and should be provided with the rubric during task directions.

General Assessments

- The student will generate a timeline of technological advances that have aided the study of cells.
- The student will interpret diagrams of different types of cells.
- The student will produce a cell model with a science learning log of results and interpretations.
- The student will compare and contrast the ways organelles function with the ways the departments of a city or a factory function. Draw pictures to help illustrate.

Activity-Specific Assessments

- Activity 1: Provide a short description of an imaginary crime scene that occurred outdoors and the evidence found there. Students will sort the evidence according to the type of microscope that would be best used to view the evidence items.

- Activity 2: Students will match the scientist/s to their individual contribution to the cell theory.

- Activity 5: Provide students with an unlabeled drawing of either a plant or animal cell to correctly label.

Resources

- *Cell Page*. Available online at http://sun.menloschool.org/~cweaver/cells
- *Cello*. Available online at http://school.discovery.com/lessonplans/programs/cello/
- *Cells Alive*. Available online at http://www.cellsalive.com
- *Comparison of Plant and Animal Cells*. Available online at http://waynesword.palomar.edu/lmexer1a.htm
- *Model Cell*. Available online at http://www.sciencenetlinks.com/lessons.cfm?DocID=101
- *Model lessons for Science.* Louisiana Department of Education. May, 2002.
- A Tour of the Cell http://www.nsf.gov/news/overviews/biology/interactive.jsp
- Cell Explorer http://www.exploratorium.edu/traits/cell_explorer.html
- Introduction to Cell and Virus Structure-Teacher Resource http://micro.magnet.fsu.edu/cells/index.html
- Inside the Cell http://publications.nigms.nih.gov/insidethecell/