

Unit Summary

The hands-on activities in Frey's Inquiry Investigations™ Module *Cellular World* link to core science concepts, making them an excellent complement to existing curricula. Students investigate plant and animal cells, osmosis and diffusion, biochemical reactions, mitosis and meiosis, and cell growth curves.

The Inquiry Investigations™ Module *Cellular World* consists of seven investigative units featuring eighteen hands-on laboratory activities. Each unit begins with a thorough introduction of the science skills and concepts presented in the lab activities that follow. The lab investigations can be performed in sequence (see pacing chart) or separately based upon the time available.

Suggested *Going Further* investigations allow students to design and carry out their own investigations, expanding their knowledge and understanding of the cellular world.

Unit 1: Cell Types and Organization

Lab 1: Exploring the Cellular World

In **Activity 1**, students observe cells and classify them as prokaryotic or eukaryotic. They also learn about life characteristics of prokaryotic and eukaryotic cell types.

In **Activity 2**, students observe cells in tissues, measure the size of cells and cell organelles, and learn that cells in tissues are specialized.

Suggested *Going Further* investigations provide students with the opportunity to make section whole-mount microscope slides and investigate how leaves breathe.

Unit 2: Cell Structure and Function

Lab 2: Learning About Cell Structure and Function

In **Activity 1**, students compare the structural differences between plant and animal cells.

In **Activity 2**, students observe the genetic material in plant root tips—an area of rapidly dividing plant tissue.

In **Activity 3**, students identify major cellular organelles in plant cells.

In **Activity 4**, students observe the effect of exposing cells to hypertonic, hypotonic, and isotonic solutions.

Suggested *Going Further* investigations allow students to further examine their prepared microscope slides.

Unit 3: Cell Processes

Lab 3: Examining Cell Processes

In **Activity 1**, students simulate the semi-permeable nature of the cell membrane by constructing models of cells using dialysis tubing.

In **Activity 2**, students study the effects of diffusion through a semi-permeable membrane.

Suggested *Going Further* investigations allow students to further study hypertonic, hypotonic, and isotonic solutions.

Unit 4: Cells and Energy

Lab 4: How Cells Cycle Energy

In **Activity 1**, students observe how the biochemical reactions of cellular respiration and photosynthesis cycle the compound carbon dioxide (CO₂).

In **Activity 2**, students learn how the cellular enzyme catalase degrades a cellular poison—hydrogen peroxide (H₂O₂).

In **Activity 3**, students learn about the use of chromatography in separating and identifying compounds. Students perform a chromatographic analysis to identify the pigments of green and autumn leaves. Students also calculate the retention factor (R_F) values of individual pigments.

Suggested *Going Further* investigations allow students to explore how excessive heat or cold affects enzymes.

Unit 5: Cell Reproduction and the Cell Cycle

Lab 5: Exploring the Cell Cycle

In **Activity 1**, students grow onion roots that they will use in the following activities.

In **Activity 2**, students stain and mount onion root tip cells for microscopic examination. Students also observe chromosomes in a rapidly dividing plant tissue and identify the phases of mitosis in plant and animal cells.

In **Activity 3**, students simulate the phases of mitosis and identify the differences between plant and animal mitosis. Students also compare and contrast mitosis and cytokinesis.

In **Activity 4**, students simulate the phases of Meiosis (I, II) and the phenomenon of crossing over. Students learn about the role chromosomes play in the process of reproduction and compare the processes of mitosis and meiosis.

Suggested *Going Further* investigations allow students to investigate what happens when sex chromosomes do not separate properly during meiosis.

Unit 6: Cell Growth

Lab 6: Exploring Cell Growth

In **Activity 1**, students observe the process of diffusion and predict how cell size influences the rate of diffusion.

In **Activity 2**, students observe cells in culture and measure cell population using optical density.

Suggested *Going Further* investigations allow students to investigate how many microbes survive in milk after pasteurization.

Unit 7: Comprehensive Inquiry Investigation

Lab 7: Culminating Lab

In **Activity 1**, students develop a biochemical test for catalase, a cell enzyme. Students use their test to determine the presence of the enzyme in cells from members of different kingdoms.

Suggested *Going Further* investigations allow students to investigate factors that affect enzyme activity.