Unit 1 Projects

Inquiry Project
Investigating Phases of Mitosis (Student textbook pages 126)

Pedagogical Purpose

Students plan and conduct an investigation to examine the relative amount of time each phase of mitosis takes in onion root tip cells. The project provides an opportunity for students to demonstrate their planning and inquiry skills. In addition, students will demonstrate an understanding of the cell cycle in plants.

Planning		
Materials	Knife Microscope slide Paper towel Cover slip **BLM G-13 Using a Microscope** Green onion, or yellow onion that has been allowed to grow in water for a few days	1 M hydrochloric acid Stain (such as 1% toluidine blue) Water Microscope Graph paper
Time	30 min to plan and initiate 30 min to perform and record 30 min to communicate	
Safety	Students should use caution when using the knife to slice their root tips and should always cut away from their bodies. Hydrochloric acid is a strong acid. Students should follow the safety rules for working with acids. They need to wear gloves, goggles, and aprons, and avoid direct contact with the acid.	

Background

Onion root tips are ideal specimens for high school level investigations of the phases of mitosis. Onions have very large chromosomes compared to many other plants. Onion chromosomes are also very dark and therefore visible when stained.

Activity Notes and Trouble Shooting

- Refer students to Figure 1.25 (student textbook pages 34 and 35) if they require a review of the phases of mitosis.
- Have students review the procedure they followed for Inquiry Investigation 1-B (student textbook pages 48 and 49).
- Direct students to the Science Skills Toolkit 8 Using a Microscope (student textbook pages 546 and 547). Have them read and review the Instant Practice section, which reviews the staining of onion root tip.
- You may wish to have groups review each other's procedures before submitting them to you for a safety check.
- As a class, decide on and communicate the criteria on which presentations will be assessed. You may wish to use the rubric on the next page, **BLM A-46 Presentation Rubric,** or work together to determine the criteria for assessment.
- To assess students' process, use **BLM A-42 Design an Investigation Rubric.**

Additional Support

- DI Logical-mathematical and spatial learners may particularly enjoy and excel at this activity. Try to put one of these types of learners in each group.
- DI Have a class discussion on how many cells students think would be appropriate to count for scientific validity. Logical-mathematical learners may want to explore points raised in this discussion further or may feel comfortable taking a leadership role in these discussions.

- DI English language learners and spatial learners may wish to present their findings using primarily visual components.
- ELL Have English language learners note any unfamiliar words, such as *validity, conventions,* and *discrepancies,* and add definitions to a glossary in their notes.
- You may wish to have a class discussion to decide on the type of graph suitable for summarizing data and illustrating the relative amounts of time for each phase of mitosis.
- You may wish to discuss Analyze and Interpret question 1 as a class to compare results and brainstorm possible reasons for discrepancies between results and previous knowledge.
- Have a class discussion on Analyze and Interpret question 4. Have students brainstorm practical benefits that might result from knowing the relative length of time of each phase.
- Provide students with **BLM G-14 Using a Microscope.**
- Refer students to Math Skills Toolkit 3 Organizing and Communicating Scientific Results with Graphs on pages 556 and 557 of the student textbook.

Rubric

Achievement Chart Category	Level 1	Level 2	Level 3	Level 4
Knowledge and Understanding	Describes the cell cycle in plants, including a description of mitosis, in limited detail.	Describes the cell cycle in plants, including a description of mitosis, in some detail.	Describes the cell cycle in plants, including a description of mitosis, in considerable detail.	Describes the cell cycle in plants, including a description of mitosis, in thorough detail.
Thinking and Investigation	Describes an appropriate procedure in limited detail. Identifies the number of cells required for scientific validity with limited accuracy. Proposes a conclusion that either confirms prior knowledge or describes possible reasons for discrepancies with limited effectiveness. Describes the treatment of challenges in limited detail.	Describes an appropriate procedure in some detail. Identifies the number of cells required for scientific validity with some accuracy. Proposes a conclusion that either confirms prior knowledge or describes possible reasons for discrepancies with some effectiveness. Describes the treatment of challenges in some detail.	Describes an appropriate procedure in considerable detail. Identifies the number of cells required for scientific validity with considerable accuracy. Proposes a conclusion that either confirms prior knowledge or describes possible reasons for discrepancies with considerable effectiveness. Describes the treatment of challenges in considerable detail.	Describes an appropriate procedure in thorough detail. Identifies the number of cells required for scientific validity with a high degree of accuracy. Proposes a conclusion that either confirms prior knowledge or describes possible reasons for discrepancies with a high degree of effectiveness. Describes the treatment of challenges in thorough detail.
Communication	Organizes data collected with limited effectiveness. Displays data graphically with limited accuracy.	Organizes data collected with some effectiveness. Displays data graphically with some accuracy.	Organizes data collected with considerable effectiveness. Organizes data graphically with considerable accuracy.	Organizes data collected with a high degree of effectiveness. Organizes data graphically with a high degree of accuracy.
Application	Describes the practical benefits of knowing the relative times of the phases of mitosis in limited detail.	Describes the practical benefits of knowing the relative times of the phases of mitosis in some detail.	Describes the practical benefits of knowing the relative times of the phases of mitosis in considerable detail.	Describes the practical benefits of knowing the relative times of the phases of mitosis in thorough detail.

Please also see **BLM A-49 Unit 1 Inquiry Investigation Rubric.**

An Issue to Analyze
Organ Donation (Student textbook page 127)

Pedagogical Purpose

In the process of becoming scientifically literate, students are asked to use their scientific skills and knowledge to make a recommendation related to a medical technology. Scientifically literate students reflect on what they have learned and apply that knowledge when considering the economic, political and ethical issues related to medical technology. This analysis is an opportunity for students to demonstrate knowledge and understanding from this unit and apply it to a real world example.

Planning	
Materials	Sources such as newspapers, magazines, Internet, and people
Time	2 weeks (in and out of class) for research 1 or 2 periods for presentations

Background

The Trillium Gift of Life Network is Ontario's organ and tissue donation agency. It was established in 2000 in order to increase organ and tissue donation in Ontario and improve processes in the donation system. According to the network's web site, one donor can save as many as eight lives and can improve the lives of 75 additional people.

Activity Notes and Troubleshooting

- Bring in relevant newspaper or magazine articles about medical technologies that may be useful in supporting patients in need of a new organ.
- Ask students to clip and bring in articles that they find in the media that may provide useful information for the project.
- As a class, decide on and communicate the criteria on which recommendations will be assessed. You may wish to use the rubric on the next page, or work together to determine the criteria for assessment.
- Direct students to use a variety of sources for their research such as electronic, print, and public broadcast. If possible, invite an expert who can speak about the organ donation issue and answer student questions.
- To assess students on the various processes and skills used in this inquiry, you may wish to use **BLM A-44 Research Project Rubric** and **BLM A-45 Collecting Information Rubric.**
- To assess students' products, you may wish to use **BLM A-46 Presentation Rubric** or **BLM A-47 Communication Rubric.**

Additional Support

- DI Linguistic learners may particularly enjoy and excel at this activity. If possible, have one of these types of learners in each group and encourage peer tutoring. Ensure that each student contributes to the final product.
- ELL Have English language learners note any unfamiliar terms, such as *black market, conventions,* and *discrepancies,* and add definitions to a glossary in their notes.
- Allow students to select from a wide range of presentation formats.
- Have students develop key visuals to match and support their findings. This could become an appendix or chart attached to their recommendation letter or an additional deliverable covered in the class-developed rubric.
- Students may find that **BLM G-18 How to Do a Research-Based Project** or **BLM G-20 Research Worksheet** helps them get started.

- **BLM G-4 Analyzing Issues—Science, Technology, Society, and the Environment** may help them structure their recommendations.
- Students may find **BLM A-5 Investigating an Issue Checklist** helpful when forming an opinion to base their recommendation on.
- This activity could be extended to have students discuss or debate the recommendations presented by each group.

Rubric

Achievement Chart Category	Level 1	Level 2	Level 3	Level 4
Knowledge and Understanding	Describes the scientific and technical principles related to medical technology in limited detail.	Describes the scientific and technical principles related to medical technology in some detail.	Describes the scientific and technical principles related to medical technology in considerable detail.	Describes the scientific and technical principles related to medical technology in thorough detail.
Communication	Organizes research with limited effectiveness. Communicates a recommendation for a chosen audience and purpose with limited effectiveness. Communicates using scientific vocabulary with limited effectiveness.	Organizes research with some effectiveness. Communicates a recommendation for a chosen audience and purpose with some effectiveness. Communicates using scientific vocabulary with some effectiveness.	Organizes research with considerable effectiveness. Communicates a recommendation for a chosen audience and purpose with considerable effectiveness. Communicates using scientific vocabulary with considerable effectiveness.	Organizes research with a high degree of effectiveness. Communicates a recommendation for a chosen audience and purpose with a high degree of effectiveness. Communicates using scientific vocabulary with a high degree of effectiveness.
Application	Identifies the economic, political, and ethical issues related to technology with limited accuracy. Makes a recommendation based on a risk-benefit analysis with limited accuracy. Proposes alternative courses of action with limited effectiveness.	Identifies the economic, political, and ethical issues related to technology with some accuracy. Makes a recommendation based on a risk-benefit analysis with some accuracy. Proposes alternative courses of action with some effectiveness.	Identifies the economic, political, and ethical issues related to technology with considerable accuracy. Makes a recommendation based on a risk-benefit analysis with considerable accuracy. Proposes alternative courses of action with considerable effectiveness.	Identifies the economic, political, and ethical issues related to technology with a high degree of accuracy. Makes a recommendation based on a risk-benefit analysis with a high degree of accuracy. Proposes alternative courses of action with a high degree of effectiveness.

Please also see **BLM A-50 Unit 1 Issue to Analyze Rubric.**