

TEACHER'S GUIDE FOR EIGHTH GRADE INQUIRY IN THE GARDEN - STAGE 3

Flower Power- The Genetic Journey



Desert Botanical Garden website

OVERVIEW

The purpose of this activity is to move students through the completion of an investigation using the scientific process. Before their visit to the Desert Botanical Garden, students made observations, asked questions, and developed a hypothesis which they then tested during their field trip to the Garden. In this activity, students analyze their results and draw conclusions about how seeds germinate when conditions are favorable.

After reviewing their experiences from their field trip to the Desert Botanical Garden, students complete a *Study Guide* in which they describe their investigation and state their conclusions. To share their work with others, students are encouraged to post their findings and diagrams online at the Desert Botanical Garden website.

MATERIALS

- *Data Collection Journal* (from the DBG fieldtrip)
- *Student Study Guide-Flower Power- the Genetic Journey - Results and Conclusions*

PROCEDURES

1. Review and discuss the students' experiences during their trip to the Desert Botanical Garden. Have students share which pollinator or flower they were for the "Partners in Pollination" game. Ask a few pollinator partners to identify each other and state why they were a good match. Ask students what word is used to describe a relationship that benefits both organisms involved (mutualism). What kind of relationship is mutualism? (A type of symbiotic relationship.)
2. Review and discuss the "Defend Your Fruit" game. Who had real fruits? Who didn't? Ask students what makes a fruit, a fruit. (A fruit contains seeds and is the mature ovary of a flower.)
3. Discuss the genetic traits that students looked at during their trip. Have them describe the different traits they observed in plants as well as the traits they looked at in humans. If necessary, have students refer to their *Data Collection Journals*. Which students had which traits? What was the dominant expression of the trait in each characteristic measured? What are the possible gene pairs when the dominant trait is expressed? (TT or Tt)

After that class discussion, students can individually complete the Organize and Analyze section of their *Data Collection Journals* to recap the lifecycle of angiosperm plants.

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4. During their visit to the Garden, students carried out an investigation that they had originally started in the classroom. Call on students to describe the investigation. Review students' hypothesis and discuss how they tested the hypothesis.
5. Hand out the *Student Study Guide – Results and Conclusions*, one to each student. Give students time to complete the *Study Guide Part A* then conduct a wrap-up discussion using *Part B “Questions for Discussion”* as a guide.
6. Allow for adequate time (both in class and as homework) for students to complete *Part C* (the *Final Project*) of their Study Guides. (Students could work in teams for their *Final Projects*.) Have students present their Final Projects to the rest of the class, discussing each in turn. Encourage students to post their projects online at the *DBG Journal of Student Findings*. Discuss with students the importance of sharing scientific information.

POST YOUR FINDINGS ON THE INTERNET!

The final step of the Inquiry Process is to share your findings. Students may share their Final Projects as well as their investigation findings by visiting the DBG Journal of Student Findings at <http://www.dbg.org/index.php/digital/students/journal>. Here, students can submit findings, project work, or original art inspired by their Inquiry in the Garden. For more ideas on art projects that tie into Garden themes, teachers can go to the Additional Resources section of the Digital Learning website.

Student Name _____ Teacher _____

Instructions: Based on your experiences in class and during your field trip to the Desert Botanical Garden, answer the questions below. If necessary, refer to your Data Collection Journal (from the field trip). Be sure to answer all the "Questions for Discussion." Complete the Final Project. Submit your work online on the DBG Journal of Student Findings as instructed by your teacher

Part A. Investigation Report

1. What was your class hypothesis about desert seeds?

2. What observations did you make both in the classroom and at the Desert Botanical Garden that led you to that hypothesis?

3. What question does your hypothesis attempt to answer?

4. Did you make a prediction about desert seeds and if so what was your prediction?

continued

Part B. Questions for Discussion

1. What was common to the seeds that were more difficult to crack?

2. What do you think would be the results if you conducted the experiment with other desert seeds?

3. Do you think there may be some desert seeds that would yield different results? Why? What might be different about those seeds?

4. Based on your findings, what are some other questions that arise that might lead to new investigations?

5. In the space below, draw a picture of a seed and the three main parts you studied:

Student Name _____

Teacher _____

6. What is dormancy

7. What part of the seed aids in dormancy? How?

8. Why is dormancy in desert seeds a good survival strategy?

9. Describe some ways a hard seed coat could be cracked or softened in a desert environment.

10. Why is it important for seeds to survive? What information do seeds carry?

Part C. Final Project: Now that you know something about how desert seeds survive in the harsh, desert environment, consider other environments and the survival challenges seeds might have in those environments. Consider conditions such as freezing temperatures, constant rains and flooding, or salty mud flats. Select an environment and describe the environmental conditions to which plants and their seeds must adapt. Following the scientific method, state observations and questions and create a hypothesis about how seeds adapt to that environment. Describe how you could test your hypothesis, including step by step instructions for following your experiment. If possible, conduct the experiment!

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RELATED ADE STANDARDS:

READING STRAND 3: COMPREHENDING INFORMATIONAL TEXT

CONCEPT	PERFORMANCE OBJECTIVE
C2: Functional Text	PO 1: Use information from text and text features to determine the sequence of activities needed to carry out a procedure.

WRITING STRAND 3: WRITING APPLICATIONS

CONCEPT	PERFORMANCE OBJECTIVE
C2: Expository	PO 1: Record information (e.g., observations, notes, lists, charts, map labels and legends) related to the topic.
C6: Research	PO 2: Write an informational report that includes: <ol style="list-style-type: none"> a focused topic appropriate facts and relevant details a logical sequence a concluding statement a list of sources used

LANGUAGE ARTS STANDARD 3: LISTENING AND SPEAKING

STANDARD	PERFORMANCE OBJECTIVE
Students effectively listen and speak in situations that serve different purposes and involve a variety of audiences.	LSE3: Interpret and respond to questions and evaluate responses both as interviewer and interviewee

SCIENCE STRAND 1: INQUIRY PROCESS

CONCEPT	PERFORMANCE OBJECTIVE
C1: Observations, Questions, and Hypotheses	PO 1: Formulate questions based on observations that lead to the development of a hypothesis. PO 2: Use appropriate research information, not limited to a single source, to use in the development of a testable hypothesis. PO 3: Generate a hypothesis that can be tested.
C3: Analysis and Conclusions	PO 1: Analyze data obtained in a scientific investigation to identify trends. PO 2: Form a logical argument about a correlation between variables or sequence of events (e.g., construct a cause-and-effect chain that explains a sequence of events). PO 4: Formulate a future investigation based on the data collected. PO 5: Explain how evidence supports the validity and reliability of a conclusion. PO 8: Formulate new questions based on the results of a previous investigation.
C4: Communication	PO 1: Communicate the results of an investigation. PO 3: Present analyses and conclusions in clear, concise formats. PO 4: Write clear, step-by-step instructions for conducting investigations or operating equipment PO 5: Communicate the results and conclusion of the investigation.

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SCIENCE STRAND 4: LIFE SCIENCE

CONCEPT	PERFORMANCE OBJECTIVE
C2: Reproduction and Heredity	<p>PO 2: Explain the basic principles of heredity using the human examples of:</p> <ul style="list-style-type: none"> • eye color • widow's peak • blood type <p>PO 3: Distinguish between the nature of dominant and recessive traits in humans.</p>

SCIENCE STRAND 4: LIFE SCIENCE

CONCEPT	PERFORMANCE OBJECTIVE
C4: Diversity, Adaptation, and Behavior	<p>PO 1: Explain how an organism's behavior allows it to survive in an environment.</p> <p>PO 2: Describe how an organism can maintain a stable internal environment while living in a constantly changing external environment.</p> <p>PO 3: Determine characteristics of organisms that could change over several generations.</p> <p>PO 5: Analyze the following behavioral cycles of organisms: dormancy (plants)</p> <p>PO 6: Describe the following factors that allow for the survival of living organisms: pollination</p>

EDUCATIONAL TECHNOLOGY STRAND 1: CREATIVITY AND INNOVATION

CONCEPT	PERFORMANCE OBJECTIVE
C4: Original Works	PO 2: Use digital tools to collaborate with a group to communicate original ideas, products, or projects effectively in a creative or innovative style.

EDUCATIONAL TECHNOLOGY STRAND 6: TECHNOLOGY OPERATIONS AND CONCEPTS

CONCEPT	PERFORMANCE OBJECTIVE
C2: Applications	PO 7: Identify and use network protocols for moving files and secure web access.

WORKPLACE SKILLS

STANDARD	PERFORMANCE OBJECTIVE
IWP-E4: Respond to oral and written presentations by formulating relevant feedback, expressing opinions, discerning the main idea and distinguishing fact from opinion.	<p>PO 1: Summarize main ideas of an oral or written presentation</p> <p>PO 3: Formulate related questions in a presentation</p> <p>PO 4: Express opinions relating to the main idea in a presentation</p>