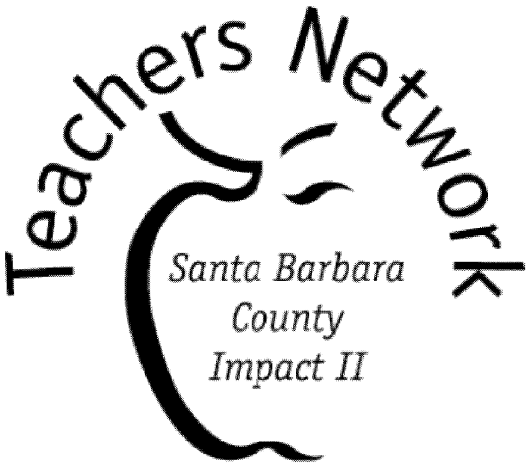
Flower Power: Attracting the Perfect Pollinator

Peggy Lubchenco, Megan Cotich



2006 Project Grants
Santa Barbara County Education Office

Flower Power Unit

By Peggy Lubchenco & Megan Cotich (La Colina Junior High, Santa Barbara, CA)

Summary of what we do:

After learning about the anatomy of flowers through a hands-on flower dissection and about the characteristics of 7 plant pollinators, students design their own three dimensional flowers that are engineered to attract specific pollinators. Students present their own unique flowers in class and classmates try to predict the identities of their pollinators. Next students find a real flower that attracts their focus pollinator and they choose to either take a digital picture of it, draw or paint it, or take an imovie of it. The essence of science is finding patterns in nature and the study of plant/pollinator relationships is a keystone pattern.

Content Standards Justification:

CA Content Standards addressed by this project: 7th grade life science; Evolution (3. a & b), Structure & Function in Living Systems (5. f), Investigation 7 Experimentation (7.d). Grades 9 - 12 Biology/Life Science; Evolution (7. a), (8. a).

In Depth Description of What We Do and Why:

It is difficult to imagine our Earth without flowering plants. They are pervasive on land and we have become dependent on them for many of our needs including food, clothing and shelter. But this has not always been the case for planet Earth. The first known flowering plant, a water lily, dates from 140 million years ago. Since that original plant, we now have in excess of 250,000 species of flowering plants. This assignment challenges students to think about this speciation and how it came about.

In the first of two lessons on plants, students will become intimately acquainted with the anatomy of flowering plants by dissecting, drawing, and labeling them. We collect a diverse group of flowers from our gardens and allow students to select some to dissect. As they dissect the plants, they draw and label the major parts of the flowers. Students will notice that their flowers probably look very different from the model flower

diagramed in the textbook. This leads to discussions about natural selection and the survivorship of each species over time.

During the second lesson, students initially learn about the relationship between plants and their pollinators. We present in a PowerPoint Presentation the latest findings on the characteristics of pollinators, from the range of color that a hummingbird can see to the scents known to attract moths. Next we cite examples of flowers that are commonly pollinated by these pollinators. The students are then challenged to create their own unique flowers that will be designed to attract a specific pollinator. They are to incorporate as many senses as necessary to mimic strategies used by flowers. After students complete their flower projects at home, they bring them in for a class presentation. In class each student writes a common name and a scientific name (according to the rules of nomenclature) for his/her creation on one side of an index card. On the backside of the card, the student identifies the target pollinator for his/her flower creation. Students present their flower models in class and describe any necessary subtleties of the plant such as its nocturnal or diurnal status. Classmates then get to guess the identity of the pollinator. Finished products are proudly displayed on bulletin boards.

As a follow up assignment, students find two real flowers that are pollinated by two different pollinators. They bring in evidence of the flowers by taking a digital picture, drawing/painting, or taking an imovie of their specimens. All pictures must be properly labeled and contain a written explanation of the plant pollinator relationships.

Evolutionary Theory and Plants

In the described activities, students are challenged to think about why the Earth has acquired so many genetic varieties of flowering plants. If the plants that survived were the ones to be successfully pollinated than this stands as a piece of evidence for Darwin's idea of Natural Selection. Plants that evolve a diverse gene pool are more likely to succeed as the environment changes. The Flower Power activity challenged us to think about Natural Selection and coevolution. The dissection activity acts as a precursor to the Flower Power activity. It deals with the structure and function of plant parts. The examination of flowers and their component parts helps students learn and understand plant anatomy. We assess student learning in the flower dissection activity by evaluating

the correctness of their sketches with the expectation of 85% accuracy or better in labeling. Learning in the second assignment, Flower Power, is assessed by using a detailed grading rubric. The rubric evaluates each understanding of his/her specific flower's pollinator attracting characteristics, of scientific nomenclature, and the inclusion of all required flower parts. Our goal is for students to attain a score of 40 or better on a 50 point scale. The third assignment graded using a grading rubric with a point scale of 10 points.

Complementary Materials List:

1. The Private Life of Plants (BBC - David Attenborough) video/DVD. This is awesome!!! The pollination scenes are spectacular. (~$20).
2. The 1990 Mary Anne Foote article in the Science Teacher journal about plant/pollinator relationships. A summary of this article is included in this packet.
3. A PowerPoint presentation combining a Ppt. by a UCSB evolutionary biologist Dr. Justen Whittal about his research on columbine flowers and their pollinators. Call Peggy Lubchenco up about this if you want a copy. (805) 967-4506 x313

Adaptation Tips:

Teachers of English Learners could provide the flower making materials for students to use in the Flower Power assignment. High school and GATE students could be required to write the scientific names using authentic Latin prefixes and suffixes. Advanced students could do Internet research on a specific species of pollinator. Younger students could be given larger flowers to dissect for easy handling. Elementary school students could write poems about their flower creations.

FLOWER POWER
LESSON ASSIGNMENT

CA Science Content Standards 7th grade – 3a, 3b & 5a

Overview

Soon you will create a totally unique flower! Listen carefully to and take notes on the M.A. Foote article on pollinators and flowering plants. Next invent a unique flower that you believe would attract one of the pollinators. Challenge your classmates to guess the identity of your target pollinator. Finally, discuss how scientists believe plants and pollinators have evolved to benefit each other.

Materials

Flower materials provided by students
Index cards

Procedure

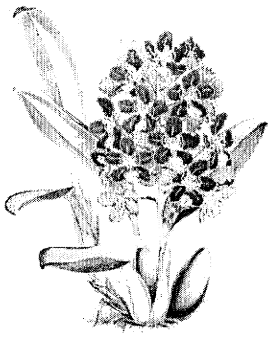
At Home

1. Choose one pollinator to "attract" (example – bat, bee, etc.).
2. Design an original flower to be a magnet for your pollinator (flower power).
    a. Use any safe materials desired.
    b. No model should exceed 15 cm x 15 cm.
    c. Try to stimulate multiple senses with the flower if appropriate.
    d. Models should be 3D.
    e. Make up descriptive "Latin" or "Greek" genus and species names for the flower (example: Pricklius beautia).
    f. Create a common name for the flower (example: Prickly Beauty).

At School

3. Write the flower's scientific name and common name on a 3-inch x 5-inch index card. Write your name on the bottom right part of the index card. Flip the card over and write the perfect pollinator for your flower on the back of the card.
4. In turn, present your flower to the class, allowing classmates to guess the identity of your flower's pollinator.
5. Turn in your flower with its accompanying index card for display in the class.
6. Discuss the concepts of natural selection and coevolution as they apply to this lesson.

Possible Questions



a. How do plants become adapted to a specific pollinator?
b. What would happen to a plant if its pollinator became locally extinct?
c. How might human intervention in plant-genetic engineering affect the plant's pollinators?
d. What happens when you transplant a flower from one continent to a new one?
e. How could a local pollinator affect the success of the agricultural crops in a region?

Summary of the Birds, the Bees,....and the Bats*

This summary is included as background material for the following Flower Power Assignment. Foote, Mary Anne (Apr. 1990) "The Birds, the Bees ...and the Bats." Science Teacher, Vol. 57, Number 4.

Pollinator	Pollinator Characteristics	Flower .....Characteristics.....	Examples
Beetle	• Poor eyesight • Poor color vision • Good sense of smell	• Large flower size • Single on stalk or small in aggregations • White or dull colored • Heavy perfume (fruity, spicy, or fermenting)	Magnolia Pond lily Dogwood Spirea
Bee	• Sight-wide range of colors, including UV • Can't see red • Taste & smell as acute as human's	• Never pure red • Might have distinctive markings in ultraviolet hues	fruits vegetables cotton clover many flowers
Carrion Fly	• Good sense of smell	• Small flowers • Inconspicuous green or brown flowers • Strong odors like dead fish, rotten meat, dung	Skunk cabbage Arum "Corpse Flower"
Moth	• Nocturnal • Good sense of smell	• White • Open at night • Sweet smelling • Flower colors yellow or pink contrast with dark of night	Evening primrose, Garden 4 o'clock
Bird (humming)	• See red • Poor sense of smell	• Not heavily perfumed • Bright colors • Usually red or yellow	Fuschia, Hibiscus, Passion fruit, Orchid, Eucalyptus, Cactus
Bat	• Nocturnal • Color blind • Good sense of smell	• Large, strong flowers • Lots of nectar • Light or greenish color • Open at night • Strong smell	Sausage Trees Saguaro Cactus Calabash
Wind	• Not consistent	• Small flowers • Odorless • No nectar • Small or no petals • Exposed pollen (and produces a lot of pollen)	Grasses, Ragweed

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Name: _____ Date: _____ Period: _____

Create-A-Flower Grading Rubric

Category	Possible Pts.	Your Points
1. State the target pollinator.	5	
2. State the flower characteristics you used to "attract" a pollinator. • • • •	15	
3. State the common name.	2	
4. State the scientific name.	5	
5. Justify the scientific name.	3	
6. The flower contains the following parts: • petals • female parts (pistil) • male parts (stamen) • stem • sepals	10	
7. Original design and thoughtful planning	10	
Possible total:	50	

Comments: