

# Peanut Butter Broccoli - Creating New Produce Through Genetic Selection

Utah Science - Heredity



## Materials

- ◆ Several varieties of one type of produce item such as apples, lettuce, or potatoes (if using lettuce—iceberg, red leaf, green leaf, Romaine, endive, butter lettuce, etc.)
- ◆ Sticky notes (several per student)
- ◆ Art supplies necessary to create an ad to share with the class

## Background

Agriculture is highly responsive to the consumer demands on produce. Traditional breeding and biotechnology are used to create fruits and vegetables consumers prefer. Selective breeding is the practice of identifying certain desirable traits in a plant or animal and breeding to obtain offspring with those desirable traits. This procedure normally takes many generations of breeding before the desired offspring results. For example, cotton plants are continually cross-bred with each other to produce cotton with longer, silkier fibers for finer quality clothing. The beef industry continually cross-breeds muscular, lean cattle to produce leaner beef.

Genetic engineering, sometimes referred to as biotechnology, is the process of adding, removing, or transferring genetic material from one organism to another. While genetic engineering has the potential to create specific desirable traits in a product, it is a complex process with limitations and is not used without great consideration. Identifying and isolating a target gene for transfer is a complex process. Scientists and biotechnology companies must consider ethics, cost, benefits and drawbacks of the process, as well as whether the final product is worth the effort.

One such product was the MacGregor tomato. This tomato was altered to resist rotting—the end result was a better-tasting fresh market tomato that could be available to consumers several months each year. This tomato proved not to be economically beneficial for continuous production. There are now other fresh market tomatoes, grown in greenhouses, that provide consumers with good-tasting tomatoes year-round.

Genetic engineering has been used to incorporate a starch gene from a bacterium into potatoes. This change allows the potato to be fried without absorbing as much oil. The end result is French fries and potato chips that contain less fat.

Besides changes made for consumer demands, biotechnology, including selective breeding, is used to aid in farming practices. For example, some varieties of carrots are grown because of their disease-resistant traits. Certain squash and cantaloupe varieties have been genetically altered to protect themselves against viruses; thus, fewer pesticides are required on these plants.

As you will continue to hear in the media, there is controversy over benefits and drawbacks of genetically engineered foods. Research continues as does open discussion about this topic. Be sure to share related news articles with your students. As always, take note of the authors of the articles and their agendas.

**Time:** Two 40-minute sessions

**Grade Level:** 5

## Science, Standard 5

Students will understand that traits are passed from the parent organisms to their offspring, and that sometimes the offspring may possess variations of these traits that may help or hinder survival in a given environment.

### Objective 1

Using supporting evidence, show that traits are transferred from a parent organism to its offspring.

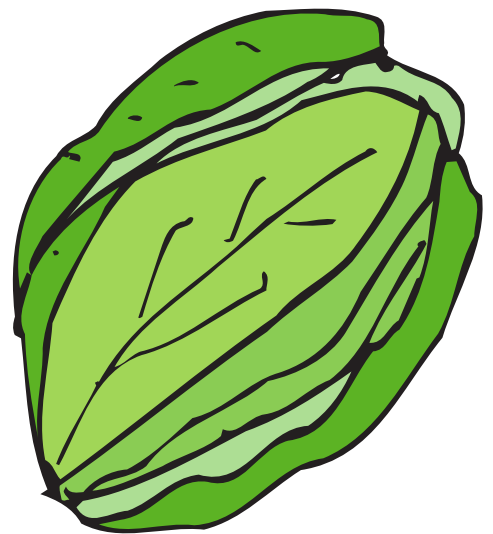
- Make a chart and collect data identifying various traits among a given population (e.g., the hand span of students in the classroom, the color and texture of different apples, the number of petals of a given flower).



Traits from different types of plants can also be combined to form a new plant, such as broccoflower (broccoli and cauliflower combined) or plumcots (plum and apricot combined). This activity, Peanut Butter Broccoli, encourages students to use their imagination in designing a new produce item. How can the students improve the food they like to eat? How can they make the foods they do not like to eat more appealing? How can crops be grown to make production easier for the farmer? Is it theoretically possible to produce the food the students have created? These sensitive topics can be addressed in this fun activity.

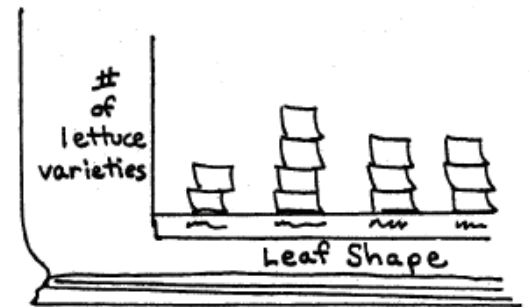
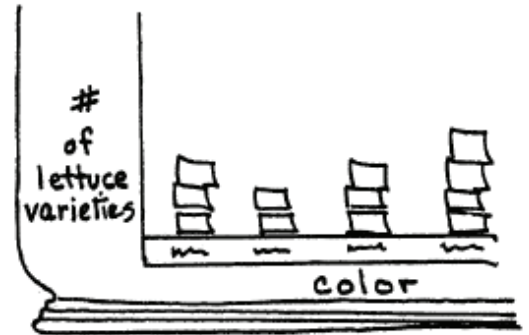
### Procedures

1. To introduce the concept of physical traits and inheritance, begin collecting information from the class regarding a certain physical trait (e.g. how many students have black hair, how many have blond hair, etc.). Differentiate between inherited traits and traits that result from changes over time (such as gray hair) or from outside sources (hair dye). Compare similarities and differences.
2. Create a bar graph showing class data you have gathered. One simple way of making a bar graph is described below:
  - Hand one sticky note to each student.
  - Have each student write his or her name on the sticky note.
  - Draw the axes of the graph on the chalkboard or on a piece of butcher paper.
  - Ask all the students with a certain trait (brown hair, for example) to bring their sticky notes to the board.
  - Arrange the notes in a single column (or bar).
  - Ask all the students with one variation of that trait (black hair, for example) to bring their sticky notes to the board.
  - Arrange these notes in a single column (or bar) parallel to the first.
  - Continue this procedure until all the sticky notes have been placed on the bar graph.
  - Label the axes.
3. Review the idea of traits and that they are obtained from one's parents. Discuss that just as people have traits, so do produce items.
4. Now the students will compare several traits of a produce item, e.g. lettuce, potatoes, or apples.
  - Divide the students into groups of 3 or 4.
  - Hand each group one variety of the produce item.
  - As a class, make a list of traits each group will analyze. If using lettuce, some traits may include leaf shape, color, head shape, taste, and leaf size.
  - To each group, pass out a sticky note for each trait to be examined (i.e. number of leaves, color, texture, size, etc.). The group should identify the expression of each trait for their variety of the produce item.
  - In advance, prepare large bar graphs for each of the selected traits for each variety. Have the students place



their sticky notes on a variety of bar graphs based on the identified traits. Some examples of bar graphs are shown on the right.

- Discuss the desirability and limitations of the various traits.
5. Working in teams of two or three, have the students design and promote an imaginary produce item. It should have various traits that will make it desirable for specific uses. For example, a group could create a two pound head of broccoli that tastes like peanut butter. It can be promoted as a non-messy, healthy, family-sized snack. The following procedure may provide guidance and encourage your students to stay on task. Encourage students to think of traits other than taste, including weather adaptations, disease resistance, length of growing cycle, or nutritional value.
- In small groups, have the students brainstorm different fun imaginary produce items that they would like to eat.
  - Have them select one item they will create.
  - Have the students decide where the desired traits will come from (i.e. another plant, bacteria, animal, eggs, etc.).
  - Explain the concepts of selective breeding and genetic engineering. Have students decide whether the item can possibly be selectively bred or must be genetically engineered. You may need to help them with this. If you are uncertain, chances are the item must be genetically engineered.
  - Have the students decide how they could promote their item.
  - Giving appropriate guidelines, have students create a magazine advertisement for their product.
6. Display the advertisements around the classroom.
7. Discuss the topic of genetic engineering and why different traits are desirable. Discuss how produce traits may be altered through natural means or through genetic engineering practices. Have the students discuss the ethics of altering traits through genetic engineering.



### Questions for Discussion, Investigation & Assessment

- Discuss real produce items that are the result of combining two produce items such as a pluimcot (plum and apricot), tangelo (tangerine and orange), or broccoflower (broccoli and cauliflower).

### Additional Activities, What's Next?

- Use magazine photos to design a new food item. Pictures can be cut out and combined to create the new item, such as a lettuce plant that also grows carrots and tomatoes.
- Instead of a magazine advertisement, have students create a television commercial, radio commercial, or newspaper article about their new food item. Videotape commercials or publish a class newspaper of student articles.

*This lesson was adapted from a lesson created by California Agriculture in the Classroom. Students who comprehend the content in this lesson should do well on the End-of-Level (CRT) tests.*