

DARWIN<sup>2009</sup>  
Exploration is Never Extinct



# Veggie Variation

## Lesson Plan

### grades K-3



**REGENERATIVE MEDICINE**  
THE FUTURE OF HEALTH  
Planetarium shows, movies and  
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## Darwin 2009: A Pittsburgh Partnership



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# Introduction

## Veggie Variation

**DARWIN**2009  
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This lesson plan was developed as part of the "Darwin 2009: Exploration is Never Extinct" initiative in Pittsburgh. Darwin2009 includes a suite of lesson plans, multimedia, on-line resources and art. Find all information on-line at: [www.sepa.duq.edu/darwin](http://www.sepa.duq.edu/darwin).

This lesson plan was originally developed for the Phipps Conservatory in Pittsburgh, PA.

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### Goals

1. To introduce the concepts of species, variation, artificial selection, and domestication.
2. To introduce the name Charles Darwin as a naturalist and his contributions to biology.

### Learning Objectives

1. The student will be able to define the terms "species," "variation," "artificial selection," and "domestication" and understand how they are related.
2. The student will be able to give examples of animals/plants that have undergone artificial selection.
3. The student will be able to identify Charles Darwin as a naturalist and his importance to biology.

### Materials, Resources, and Preparation

1. Educator should read the introductory materials provided in the Teacher Pages found online. These define the terms "species," "variation," "artificial selection," and "domestication."
2. Pictures of different dog breeds to use in a demonstration of variation within a species.
3. A children's book about how seeds grow. Educator can use the list found on Teacher Page 4.
4. A bulletin board should be available to post photos of the students' growing seeds. (If a digital camera/printer are unavailable, student drawings can be substituted.)

Note: Additional materials are listed for each activity. Materials for the Lecture are found on page 5, for the Activity on page 7, and for the Mystery Seed on page 8.

### A few things your students should already know:

1. What an organism is.
2. What a mutation is.
3. What a plant is.
4. What a scientist is.



# Teacher Pages

## Veggie Variation

### Vocabulary

1. **Artificial Selection** - When humans choose specific individuals of a species that have a desired characteristic to reproduce, in order to produce offspring with that desired characteristic.
2. **Domestication** - A synonym for artificial selection (see definition above). Can be commonly observed in dog, cat, horse, and plant species.
3. **Species** - A group of organisms (plants or animals) that are capable of breeding with other members of the same group, but are unable to produce fertile offspring with other organisms.
4. **Variation** - Differences between individuals of a species.
5. **Scientific Method** - The process used in the scientific community to solve problems or explain phenomena. The steps of the scientific method include: observation, hypothesizing, experimentation, analysis, and acceptance/rejection/modification of the hypothesis.
6. **Naturalist** - A scientist who studies nature through observation. Charles Darwin is a famous naturalist.

### Overview

There is great diversity found in the tree of life. From bacteria to sponges, to trees, to cats and birds, all life is different. We can also find differences between members of the same species. Take a minute and think about how different looking all of the dogs are that you have seen. Variations within a species are caused in part by differences in individuals' genes. These differences arise from several factors explained by inheritance and genetics. Random mutations in an individual's DNA can introduce a gene variant, which results in new traits. For example, a mutation of the gene that controls the normal coat color of a tiger (light orange) could cause new coat colors (white or dark orange) to arise. Genetic differences are not limited to simply coat color, but can affect almost every aspect of a plant or animal (size, shape, life span, etc). These random mutations, which cause variations to arise within a species, set the stage for artificial selection.





**Artificial selection occurs when humans take advantage of the variations within a species to reproduce desired characteristics.**

It should be noted that while natural selection occurs in nature, without the influence of humans, artificial selection only occurs with human influence. Artificial selection is the process of selecting individuals of the same species that share a desired characteristic and allowing those individuals to breed. For example, a species of wild grass, *teosinte*, has undergone extensive artificial selection. *Teosinte* was a wild grass with only a few kernels of fruit. Humans selected the plants with the most kernels and allowed these to breed. Over time, these plants started producing more and more kernels and developed into modern day corn. More commonly known examples of artificial selection or domestication are dog, cat, and horse breeds. Did you know that even though there are many different dog breeds that look very different from one another, they are all the same species, *Canis lupus familiaris*?

**The Importance of Observation: How Darwin started by observing and collecting life forms and discovered the principle of evolution.**

Charles Darwin, the father of evolution, was an avid naturalist. As a young boy he loved playing outside and observing the environment around him. He had a large collection of beetles and was an accomplished marksman. After graduating from college, Darwin served as a naturalist aboard the HMS Beagle where he made his famous voyage to the Galapagos Islands. While Darwin was visiting the Galapagos Islands, he carefully recorded his observations of the plants and animals he saw there. When he returned home to England, he began corresponding with many other scientists about his observations. After careful consideration, collaboration, and thought, Darwin published his famous book, *On the Origin of Species*, which outlines his theory of evolution.



**The Evolution of Corn**

### The Scientific Method

Darwin's observations were crucial to his research, but he did not follow the scientific method. Although he made careful observations and drew important conclusions from these observations, he never developed a testable hypothesis about evolution.

The scientific method is used by the scientific community to help solve problems or explain phenomena. The steps of the scientific method include:

1. **Observation** (watching and observing the subject)
2. **Hypothesis** (formulating a testable statement about the subject)
3. **Experimentation** (use of techniques to test the hypothesis)
4. **Analysis** (interpretation of the results of the experiment)
5. **Acceptance, or Rejection and Modification** of the hypothesis



# Lecture

## Veggie Variation

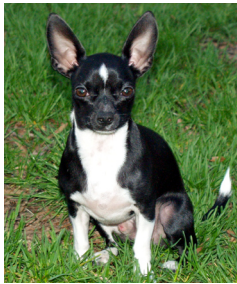
**Time: 45 minutes**

**Materials:**

- Teacher Pages (for reference)
- pictures of dog breeds
- children's book on seeds (see below)

**Suggested Book List:**

- *Seed to Sunflower*, Barbara Reid
- *Rabbit Seeds*, Bijou Le Tord
- *The Tiny Seed*, Eric Carle
- *Growing Vegetable Soup*, Lois Ehlert
- *This is Sunflower*, Lola M. Schaefer
- *Up, Down, and Around*, Katherine Ayres



**Chihuahua**



**Great Dane**



**Siberian Husky**

### Lecture

1. Ask students if they know what a "species" is. After hearing students' definitions of "species," inform the students of the scientific definition of "species."

"A species is defined as a group of organisms (plants or animals) that are capable of breeding with other members of the same group but are unable to produce offspring with other organisms."

2. Use examples such as bird species to illustrate your point.

"Everyone knows what a bird is, but do you know there are many different species of birds? A robin is a species of bird. A chicken is a species of bird. An ostrich is a species of bird. Etc..."

3. Introduce the concept of "variation." Ask students if they think that every single robin (or other bird example) looks exactly the same. After responses, talk about how some robins (or example bird) may be a brighter shade of red, or have longer legs, or a pointier beak, etc.

"Variation is the idea that there are small differences between members of the same species."

4. At this point, introduce the concept of "artificial selection." Define "artificial selection."

"Artificial selection occurs when humans chose specific individuals of a species with a desired characteristic (brighter coloring, longer legs, etc.) and allow these individuals to reproduce to produce offspring with those desired characteristics."

Be sure to explain that artificial selection is also known as "domestication."

### Demonstration

1. To demonstrate the interplay between species, variation, and artificial selection, use pictures of different dog breeds to help explain the concepts.

For example, you can use pictures of a Chihuahua, a Great Dane, and a Siberian husky to show that even though the dogs look different (variation), all are the same species - "*Canis lupus familiaris*" - and that their unique looks or characteristics were selected by humans (artificial selection).

2. Tell students that variation and artificial selection are not only found in dog breeds but also in other plants and animals.

Examples- horse breeds, cat breeds, and vegetables.



# Lecture

## Veggie Variation

### Discussion

Read one of the children's stories found in the book list on page 4 to the class to learn about plants. (optional)





# Activity

## Veggie Variation

**Time: 30-60 minutes**

**Materials:**

- fresh broccoli, kale, kohlrabi, and Brussels sprouts
- plates

### Activity

1. Set out plates of broccoli, cauliflower, kale, kohlrabi, and Brussels sprouts. Encourage students to look, smell, touch, and taste the various vegetables.
2. While students are observing the vegetables, explain that scientists observe, or look at, things to learn more about what they are studying. This is the first step in the scientific method. Also explain to the students that a scientist who studies nature is called a “naturalist.” This means that the students are also being naturalists, since they are observing the vegetables.
3. Ask the children if they know who Charles Darwin was. Explain to the students that Charles Darwin was a famous naturalist who observed variation in different species of birds on the Galapagos Islands.
4. Observation led Darwin to make his most famous contribution to science - that all species evolve over time due to natural selection. Ask students if they can identify what vegetables they are looking at. Point out the different variations of the *Brassicaceae oleracea* species. (Broccoli, Cauliflower, Kale, Kohlrabi, Brussels sprouts) Explain to the students that they are all the same species of plant.
5. Ask the students if they remember what the definition of a species is. If the students do not remember, redefine species for them.  
 “A species is defined as a group of organisms (plants or animals) that are capable of breeding with other members of the same group but are unable to produce offspring with other organisms.”
6. Ask the students why they think the vegetables look different. Hopefully, artificial selection will be given as an answer. If artificial selection was not mentioned, explain that the vegetables were artificially selected for by humans. This produced the different vegetables you see on display.
7. Ask the students what they think the original *Brassicaceae oleracea* species might have looked like. (There is no wrong answer here, it is just a question to get the children’s minds thinking creatively.) If there is extra time, have your students draw and present their hypothesis.



# Post-Activity

## Veggie Variation

### Mystery Seed Set-Up

Mix the various basil seeds together in a small bag.

**Time: 30 minutes**

#### Materials:

- seeds for the following types of basil: sweet, lemon, cinnamon, thai, red rubin, and fino verde
- small pots for planting
- potting soil
- garden trowel
- small bag
- bulletin board
- digital camera/printer (optional)
- paper, crayons, markers (optional)

If possible:

- computer with internet access to open the page <http://www.sepa.duq.edu/darwin/mysteryseed.html>. If not possible, consider printing out this page ahead of class.

### Activity

1. Give each student a pot, and have them fill the pot with potting soil. Have students make a 1-inch deep hole in the potting soil with their fingers. Allow each student to choose a seed from the bag and place it in the hole in their pot. Cover the seed with soil. Make sure that each student labels their pot.
2. You can then have the students place their pots on a sunny window sill in the classroom. (If space is not available in the classroom, students can be allowed to take their plants home and monitor their progress there.) Remind student to water their seeds with a few drops of water twice a day.
3. Monitor the growth of the various seeds. If a digital camera is available, take pictures of the plants at various stages of growth. (ex. 1 week, 10 days, 2 weeks)  
  
Visit the Regenerative Medicine Partnership in Education website (<http://www.sepa.duq.edu/darwin/mysteryseed.html>) to compare growing seeds to the various types of basil they might be. The photos can then be posted on a bulletin board. If a digital camera and printer are not available for use, have the students draw a picture of their growing seed to post on the bulletin board.
4. Challenge: If your students grow several different seeds, you can encourage them to be attentive to:
  - How soon can they identify their plant?
  - How long into their development were their plants indistinguishable?
  - What plants are more similar and which are more different?
  - In how many ways are the plants different? (touch/smell/look/taste)
5. Challenge: encourage your students to build a poster that describes what they learned about Domestication or Artificial Selection, which uses the documentation (images) they created about the basil plants.





# Post-Activity

## Veggie Variation

### Discussion

As a wrap-up activity, have a class discussion about species, variation, and artificial selection. Important questions to ask include:

- What is a species? Can you give an example of a species?
- What is variation?
- Can you give an example of variation in a species?
- What is artificial selection?
- Can you name a species that has undergone artificial selection?