

Lesson Template

Subject Area(s) AP Biology
Associated Unit Biotechnology

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Yellow highlight = required component

Lesson Title The Purple Carrot

Grade Level 11(10-12)

Lesson # __ of __

Lesson Dependency

Time Required 20 minutes

Summary

As a way to introduce plant anatomy, a brief discussion of the genetic engineering of carrots will incite the students to learn more. This lesson also provides an introduction to bioengineering.

Engineering Connection

Engineers are trying to improve the foods we eat so as to improve our health. The Vegetable and Fruit Improvement Center program at Texas A&M University is continually improving food based on the needs of our community.

Engineering Category

1. relates science concept to engineering,

Keywords

Agriculture, Bioengineering, Carrots, Food, Genetic engineering,

Educational Standards

- Science: Texas, science, 2009, The Texas Essential Knowledge and Skills, Chapter 112,
3F research and describe the history of biology and contributions of scientists.
6C identify and illustrate how changes in DNA cause mutations and evaluate the significance of these changes.
6D compare genetic variations observed in plants and animals.
8C identify characteristics of kingdoms including archaeobacteria, eubacteria, protists, fungi, plants, and animals.
10C analyze and identify characteristics of plant systems and subsystems.
13B survey and identify methods of reproduction, growth, and development of various types of plants.

Pre-Requisite Knowledge

The students should have a basic understanding of DNA.

Learning Objectives

After this lesson, students should be able to:

- Explain the basis for genetic engineering

Introduction / Motivation

What vegetable was the first to be canned? What vegetable is referred to as 'Honey Underground'? Originally from Afghanistan, what vegetable comes in white, orange, purple, red, and yellow? The answer to all these questions is carrots! Carrots were originally not orange. In the 17th Century the Dutch cultivated orange carrots. They selectively pollinated the plant to produce sweet orange carrots.

Today Texas A&M University is genetically engineering carrots to have a maroon skin and contain 40% more beta carotene than regular carrots. These "BetaSweet" carrots are sweeter than regular carrots and have a better texture. They also have anthocyanin, which is an effective compound recognized for the prevention of cancer. Anthocyanins are a class of pigments that are also antioxidants. Based on your knowledge of Chemistry, what is an antioxidant? That's right, it does the opposite of oxidizing, it reduces. Does everyone remember oxidation/reduction chemistry? Antioxidants help our body reverse the oxidizing reactions that occur naturally because of ozone, pollution, and other naturally occurring compounds. Some scientists believe that the oxidation of our cells is the main reason for premature aging. Do you want to look old? No way. So eat your fruits and veggies.

What other plants have been genetically engineered for our benefit? (Onions, Citrus, Melons, Peppers, Plums, Peaches, Nectarines, Spinach, etc) Some foods have been selectively bred for color or flavor, and now for health benefits. Besides health benefits, what are other reasons to genetically engineer our vegetables and fruits? (pest-resistant, drought-resistant, frost-resistant, disease-resistant, higher yields, etc)

Lesson Background & Concepts for Teachers

For more info on Texas A&M University Vegetable and Fruit Improvement Center:

<http://vfic.tamu.edu/index.htm>

Image

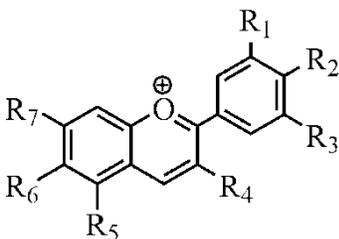


Figure 1

ADA Description: General chemical structure of anthocyanins

Caption: Figure 1. General chemical structure of anthocyanins

Image file name: anthocyanins.tif

Source/Rights: made by self via ChemDraw

Vocabulary / Definitions

Word	Definition

Associated Activities

Lesson: Animals and Engineering

Activity: Glowing Flowers

Lesson: The Cloning of Cells

Lesson Closure

Now that we know scientist genetically engineer food, what's next? The human genome project has completely mapped out human DNA. So should scientist try to engineer a human baby? Do you think they can engineer a human? Think about cloning, it works for sheep, dogs, and other lower animals. What if scientists were able to clone and grow organs? There would never be a need for organ donors again. Scientists have genetically engineered rabbits and flowers to glow in the dark. What if humans were able to glow in the dark?

Have the students debate the pros and cons of genetic engineering and associated technology. Assign them to teams and give each team a topic (either pro or con).

Assessment

For homework, each student needs to research a vegetable or fruit that has been genetically engineered. The 2 page report shall include reasons for the manipulation and how it was done. At least 3 references are required for this report.

Each student must write a report with either the pros or cons for genetic engineering.

Lesson Extension Activities

Additional Multimedia Support

References

Attachments

Other

Redirect URL**Owner**

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