

Lesson Plan

Assessment	AOL: Activity, Exit Card
Cross-curricular	Arts and Language

Big Ideas

- The technological use of microorganisms raises many ethical issues.
- Genetic research and biotechnology have social, environmental, and ethical implications.

Learning Goals

- I know that genetic engineering is any change made to the genetic information of an organism using biotechnology.
- I can name some examples of genetic engineering.
- I can identify some benefits and risks of genetic engineering

Specific Expectations:

C1.2 analyse ethical issues related to the use of microorganisms in biotechnology (e.g., with respect to the use of bacterial insecticides, the patenting of modified microorganisms)

D1.2 evaluate, on the basis of research, some of the effects of genetic research and biotechnology (e.g., genetically modified organisms [GMOs]) on the environment

Description:

In this lesson students will extract DNA from a banana. Students will also identify some benefits, risks and examples of genetic engineering. **This lesson is intended for the college level.**

Materials

DNA Extraction:

- Ripe banana
- Half cup of water
- Teaspoon of salt
- Resealable zip-top bag
- Dishwashing soap or detergent

- Rubbing alcohol
- Coffee filter
- Narrow glass
- Narrow wooden stirrer

Safety Notes

Students should wear safety goggles during the DNA extraction activity.

Introduction

When you think of “genetic engineering” what comes to mind? With your “elbow partner”, think of all the ways in which genetic engineering may be used today and in the future.

Next, students will watch a short video about “genetic engineering” called “Can You Genetically Enhance Yourself?” <https://youtu.be/N-48RVaqZck> (VSauce).

After the video, the teacher can ask questions such as:

- What is Gene Therapy?
- What ability is enhanced in “Doogie” mice?
- Name one complication that could arise from gene therapy.

Now watch the presentation Genetic Engineering Visuals (See Link) to learn more about genetic engineering.

Action

In this activity, you will learn the first step in making recombinant DNA -- the DNA often used for genetic modification of an organism. Using simple materials, you will remove the DNA from a banana.

You will need:

- Ripe banana
- Half cup of water
- Teaspoon of salt
- Resealable zip-top bag
- Dishwashing soap or detergent
- Rubbing alcohol
- Coffee filter
- Narrow transparent glass
- Wooden stirrer like a chopstick or popsicle stick
- Tape

Note: Make sure the rubbing alcohol is kept in the refrigerator or freezer during the experiment.

Procedure:

1. Place a peeled banana into the zip-top bag, seal the bag, and squish the banana until it has the consistency of pudding (soft and smooth with no lumps).
2. Prepare half a cup of hot water with one teaspoon of salt and pour it into the bag. Mix and slosh the mixture together for about 30 seconds. Add half a teaspoon of dishwashing soap. The detergent breaks down the cell membrane and the salt separates the DNA from the rest of the cell.
3. Mix again but do not slosh enough for the mixture to become foamy. Place the coffee filter in a clear glass cup. Attach the filter to the top, either with tape or by folding over the top.

4. Pour the contents of the bag into the glass, allowing all of the liquid to drip through the coffee filter.
5. Remove the coffee filter and contents. Slowly pour the chilled rubbing alcohol into the glass so that it forms a layer separated from the banana “juice”. Let the two layers sit for 8-10 minutes. Between the layers of alcohol and banana juice, a separate layer of DNA should form. You may see a cloudy layer or bubbles.
6. Spin the wooden stirrer in the cloudy layer so that the DNA wraps around it. You should be able to remove DNA from the mixture.

Adapted from <http://www.scientificamerican.com/article/find-the-dna-in-a-banana-bring-science-home/>

Once scientists have isolated the DNA from an organism they must isolate and copy the targeted gene so that it can be inserted into the host using a vector (such as a bacteria or virus) or by microinjection. Genes may also be deleted from the host.

Consolidation/Extension

Students have the opportunity to fill in an exit card or complete a creative assignment, where they will add a specific trait to an organism of their choice and describe how adding this trait will benefit the organism and the environment.

Exit Card

List 3 examples of genetically modified organisms. What characteristic has been enhanced and how does it benefit the organism?

Assignment:

Choose a plant or animal.

- What trait would you like to enhance in this organism?
- From what other organism could you copy this trait?
- What kind of benefit would that new trait give to the organism? The environment? Society?
- Draw a diagram or make a model of this new and improved creature.