DNA Extraction Experiment

TELETHON KIDS INSTITUTE Discover. Prevent. Cure.
DISCOVERY CENTRE SCHOOLS

LESSON PLAN

RECOMMENDED FOR YEARS 4 - 6

Lesson summary

In this lesson, students follow instructions to conduct an experiment that will allow them to extract DNA from strawberries and view it. By the end of this lesson, students will have a better understanding of how all living things contain DNA.

Learning objectives

Students can follow instructions to extract DNA from strawberries.
Students can explain how all living things contain DNA.

Possible Australian Curriculum links

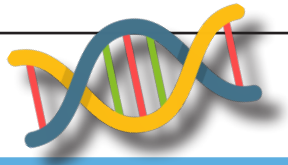
Science Understanding / Biological sciences
Science Inquiry Skills / Planning and conducting

STARTER

1. Show students pictures of various living things. Ask students to identify similarities and differences between the living things shown. For example, you might show students an image of a bird, a monkey and a person and ask them to list things they have in common (e.g. they all have two eyes) and things that are different (e.g. birds can fly, whereas monkeys and people can't).
2. Discuss with students how all living things (even plants!) contain a genetic instruction manual called DNA, which tells them to become what they are and how they function. The DNA manual is made up of only 4 letters: Adenine (A), Thymine (T), Guanine (G) and Cytosine (C). It is the different combinations of these letters that make up the information (genetic code) for making an organism or a living thing.
3. Invite a couple of students to the front of the class and provide them with Lego bricks, but all in the same colour. Explain that they will need to create a tower 10 bricks high using the bricks provided. Discuss the fact that no matter how many times they try, their towers will look identical. Now provide students with bricks in 4 different colours and ask them to build a tower 10 bricks high. This time, while the size of the towers is the same, the combination and order of colours can be different and there are many different possibilities. You can invite more students to have a try to prove this point. The Lego represents our genetic code and explains why four letters can create so many different variations amongst all living things (Why humans look different to flies, for example!).

Resources

- Lego bricks or similar (in 4 different colours)
- Strawberries
- Plastic zip-lock bags
- DNA extracting solution (mix 1 cup of dishwashing liquid and ¼ cup salt with 4 ½ litres of water)
- Gauze material or cheesecloth
- Plastic cups
- Rubber bands
- Test tubes
- Droppers
- Denatured alcohol e.g. methylated spirits or rubbing alcohol
- Paper towels



How much DNA do you share with these living things?
Fruit fly – 36%
Chimpanzee – 98%
Bacteria – 7%
Zebrafish – 85%
Mustard Grass – 15%
Round Worm – 21%

While we don't look much like a fly or a worm, believe it or not, we share genes with both of them and with every other living organism. Create a line in the classroom (you could have students imagine an invisible line or mark a line on the ground using masking tape). Explain to students that the line is like a ruler, with one end being 0% and the other end being 100%. Ask students to stand along the line to show how similar they think we are to different living things (For example, if students think we are identical to fruit flies, they should stand at 100% and if they think we don't share any genes at all, they should stand at 0%. They are also allowed to stand anywhere in between 0 to 100%). Share correct answers with students after they have made their guesses.

WOW Brain Break!

BODY

1. Explain to students that DNA is something we can't usually see with the naked eye (scientists use special microscopes to view DNA strands); however, we are going to conduct an experiment that will allow us to extract DNA from strawberries and view it.
2. Have students conduct this experiment in pairs. Ask pairs to place a strawberry in a zip-lock bag and add 2 tablespoons of the DNA extracting solution, then remove most of the air before sealing the bag tightly. Using their hands, have students mash the strawberry through the bag so there are as little solid bits as possible.
3. Have pairs place a gauze material or similar over a plastic cup, securing it in place with a rubber band. They then need to carefully pour the strawberry mixture into the cup, making sure to catch the solids with the gauze.
4. Using a dropper or pipette, have students take a dropper full of the strawberry liquid in the cup and squirt into a test tube. You don't want too much liquid so make sure it is no more than half of the tube. Add equal amounts of alcohol to the test tube, taking care not to tip the test tube or mix the two liquids together. Ask students to observe the line between the strawberry mixture and alcohol, and describe what they can see. They should be able to see a white thread-like cloud appearing at this line, which is the strawberry DNA. The DNA will clump together and float to the top of the alcohol layer.
5. Have students tidy up their workstations and carefully dispose all liquids down the drain. Ask students to share their findings before completing their lab reports individually.

Question prompts

Why do living things have different features and functions?
Why can't we see our DNA?
Why do we use dishwashing liquid and salt for this experiment?
What does the alcohol contribute to the experiment?
Will the DNA for strawberries look the same as the DNA for other fruit, such as bananas?

Health and safety

Denatured alcohol is highly toxic when consumed. Ensure the classroom is well ventilated to avoid inhaling the substance's vapours. Any spills should be cleaned up immediately and the alcohol stored appropriately away from students at the end of the experiment.

PLENARY

Explain to students that scientists have to untangle DNA in order to study their structure under a microscope. To represent this, have students play the Circle Untangle game. In groups of 5 - 10 (you may like to start with smaller groups and gradually have larger group sizes to increase difficulty), have students stand in a circle and place their hands in the centre. Ask each student to hold two other students' hands in the circle (but not the people on either side of them). Once everyone is holding onto two other people's hands, the aim of the game is to work together the untangle the circle.

THE SCIENCE BEHIND THE ACTIVITY

DNA is an instruction guide for life and tells each cell in our body what to do and how to do it. It carries the information about how a living thing looks and functions. The letters in DNA stands for deoxyribonucleic acid. DNA molecules consist of two chains wrapped around each other, forming a double helix in shape. The spirals are made up of sugars and phosphates and compose the backbone of the DNA. These spirals are connected by chemicals known as bases, which stretch between them like rungs of a ladder. The four types of bases in DNA are Adenine (A), Thymine (T), Guanine (G) and Cytosine (C).

In this experiment, we use dishwashing liquid because it busts the cells of the strawberries open, releasing the DNA. The salt ensures the proteins in the cell are not separated from the rest of the solution with the DNA. When molecules are insoluble (unable to be dissolved), they clump together and become visible. DNA is not soluble in alcohol. Therefore, by using alcohol in this experiment, it makes the DNA strands clump together and become visible to the naked eye.

Our scientists at the Telethon Kids Institute study DNA to learn more about health and different diseases. For example, DNA from twins is extra special as identical twins have the same DNA. This helps our scientists find out if the causes of health and disease are related to genetics or the environment. By studying DNA closely, our scientists can work towards finding out about the causes of disease and hunt for cures.

DNA Extraction Experiment
LAB REPORT

Name: _____ Date: _____

Title of experiment:

_____

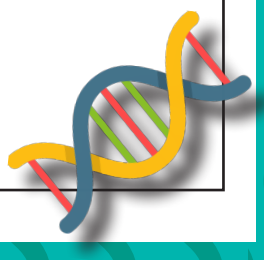
_____

Materials used:

Steps of the experiment:

Results:

Conclusion:



DNA Extraction Experiment LAB REPORT

Example Answers

Title of experiment:

Extracting DNA from Strawberries

Materials used:

- strawberries
- ziplock bag
- DNA extraction liquid
- alcohol
- dropper
- cup
- cloth/gauze material
- rubber band
- test tube

Steps of the experiment:

1. Mash the strawberries with the DNA extraction liquid inside the ziplock bag.
2. Place the cloth over the cup and secure in place using the rubber band.
3. Pour mashed strawberries through the cloth to remove solid bits.
4. Pour strawberry mixture into the test tube using the dropper.
5. Add alcohol.
6. Observe white thread-like cloud between the strawberry mixture and alcohol. This is the strawberry DNA.

Results:

We saw a white clump forming beween the strawberry mixture and alcohol. The DNA floated to the top of the alcohol layer. It looked like snot.

Conclusion:

Strawberries contain DNA.
Even though we can't see it, DNA is in all living things.