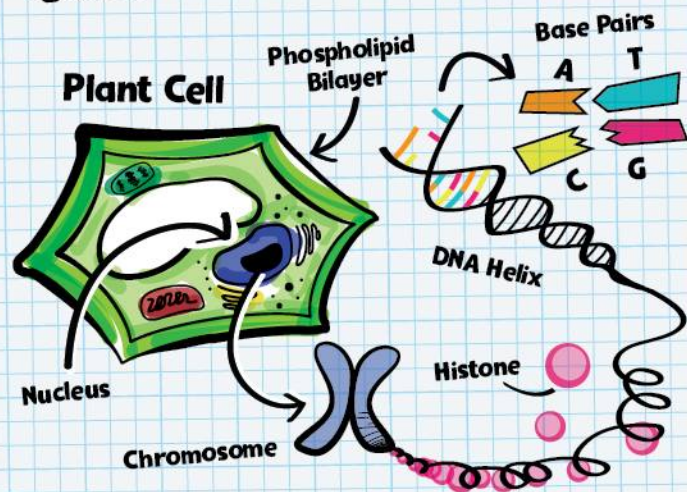


Now that's cool, but why is it doing that?



Strawberry is a plant, and plants are made up of plant cells. Each cell is like a miniature egg that contains the different stuff that keeps the cell alive, including the DNA. For us to get to the DNA, we must first crack open the "shell" of the cell, or more precisely, the cell membrane.

What's the use of soap?

The membrane is made up of what is called the **phospholipid bilayer**, with the word lipid meaning fat. You should probably know that by washing your hands with soap it removes all fatty oily substances that sticks to your hand. That means the soap inside the lysis buffer will remove the fatty layer of the cell wall, essentially "cracking the cell open"!

What's the use of salt?

The DNA sits in the deepest part of the cell called the nucleus, similar to the yolk of the egg that get nested inside the egg whites. DNA in the nucleus exists in a form called **chromosomes**, which is essentially DNA wrapped and coiled around other **chemicals**. To further separate the DNA, the salt in the lysis buffer breaks those chemicals down and unwraps it back into long, stringy chains.

What's the use of alcohol?

In the final process of DNA extraction, alcohol is added. DNA is normally dissolved in water, with the alcohol added, the DNA precipitates (meaning forming solids) from the liquid forming the strings that you see.

What is DNA and why do we need it?...

DNA or deoxyribonucleic acid is the chemical instructions for the development of all living things. It is made up of four chemical bases: **adenine (A)**, **thymine (T)**, **cytosine (C)**, and **guanine (G)** and together with other supporting chemicals they are arranged in a "double helix shape" or similar to a spiral ladder.

A single human DNA contains 3 million of these combinations of A,T,C & G's (that's a LOT!), if you have a way to unwind the DNA into a single string, it would be 2 meters long! (although it would be too thin for you to see with a naked eye). How these bases are arranged determines your features, for example whether you have blue or brown eyes, straight or curly hair; and also determines the function, essentially deciding whether you are a human or a strawberry!

What other fruit works, why?...

Apart from strawberries, kiwifruit and bananas also work well with this process of DNA extraction. The reason why these fruits work well is because they have more copies of their DNA in each cell than other fruits. For instance, strawberry is octoploid, meaning it has 8 copies of their DNA in each cell. Kiwifruit have 6 copies and Bananas have 3 copies. More copies of DNA means you get more DNA out of this experiment!



Biochemistry Collection DNA EXTRACTION SET

Included Materials

- 3 Test Tubes
- 1 Test Tube Rack
- 1 Funnel
- 1 Plastic Cup
- 1 Small Beaker
- 3 Collecting Vials
- 3 Coffee Filters
- 1 Small Magnifier
- 1 Spoon
- 1 Tweezers
- 1 Pipette
- 3 Seal Bags
- 1 Pair of Goggles
- 1 Pair of Gloves



Safety Precautions

Isopropyl alcohol is flammable and a dangerous fire risk— keep away from flames and other sources of ignition. Any food-grade items that have been used in the experiment are considered laboratory chemicals and are for lab use only. Do not taste or ingest any food in the lab and do not remove any remaining food items. Wear safety goggles, gloves, and a chemical-resistant apron. Wash hands thoroughly with soap and water after the experiment.

Organize Your Work Area

Keep your work area clean and uncluttered – before, during and after laboratory sessions. Every laboratory session should begin and end with your chemicals and laboratory equipment clean and stored properly.

You will need to prepare:

- 1 Strawberry
- Distilled water
- 91% or 99% Isopropyl alcohol
(can be purchased from pharmacies/chemist)

Procedure

Preparing the alcohol:

- 1 Always wears goggles, gloves and protective clothing while using these liquids.
- 2 Pour 40ml of alcohol into the small beaker and store it in the freezer*. The alcohol will need to be freezing cold when we perform the experiment.



* Please remember you need adult supervision when handling these liquids.

Preparing the lysis buffer:

- 3 Add 10ml of detergent or dishwashing liquid to the plastic cup.
- 4 Add some table salt to the spoon and fill it up to the "1ml" marking
- 5 Fill the small beaker with 100ml of distilled water and use the spoon to mix until all soap and salt is dissolved into the water.



Preparing the fruit:

- 6 Find one strawberry and add it to the seal bag, remove as much air you can from the bag and seal it tight.
- 7 Mash up the strawberry into a slurry by pressing the bag repeatedly*
- 8 Open the zip bag and add 20ml of lysis buffer into the bag, continue mashing the slurry for a few minutes until the clumps of strawberry have turned into liquid.



* To avoid the bag from bursting open, use one hand to grab hold on the zipper and use the other hand to squish the strawberry.

Filtering the strawberry slurry:

- 9 Assemble the test tube rack accordingly and place the funnel on one test tube
- 10 Grab a piece of filter paper and fold it in half, then fold it in half again. Open it up to make a cone shape.
- 11 Open the zip bag and pour the slurry to the filter paper, patiently wait for all the liquid to pass through the filter paper.



Extracting the DNA from the filtered slurry:

- 12 Take the alcohol out from the freezer
- 13 With your fingers, press onto the squishy part of the pipette and while doing so, dip the tube into the alcohol. Slowly release your fingers and the alcohol should travel up to the pipette.
- 14 Add 5ml of alcohol to the test tube, hold up the test tube to eye level and use the markings on the tube to measure precisely.
- 15 Now watch closely, is there something bubbly in the alcohol layer? If yes, then you have performed the experiment correctly. The DNA should appear like fine strands of spider web floating near the surface*.
- 16 Use the tweezers to gently pick up the DNA material from the test tube and store it inside a collecting vial. Be sure to show it to your friends!



* You can use the small magnifier to observe the fine strands of DNA!

Learn more about DNA over the page!

Biochemistry Collection DNA EXTRACTION SET

Why is it not working?

- 1 You may not have crushed the fruit fine enough. Try mashing the fruit in the bag for longer and harder.
- 2 Mix the lysis and slurry for 10 minutes. This will allow more time for the lipids to be destroyed. Also, using clear liquid hand soap may have better results than using dish soap.
- 3 You should not mix the alcohol with the rest of the solution at all. There should be a distinct alcohol layer above the other liquid.

Further Readings

- ? What can you do with the extracted DNA?
- ? Can you change your DNA?
- ? What is the closest related organism to a human being?
- ? Can you use DNA to store information?