**Soybean DNA Extraction**

**Objective:** Participants will perform a series of steps to extract the DNA from soybean cells

**Materials:**

* Soybeans
* Coffee bean grinder/blinder/food processor
* Chilled Isopropyl alcohol
* Dish soap
* Salt
* Water
* Zipper-lock bag
* Coffee filter
* Funnel
* 9 oz clear plastic cups
* Large beaker with ice
* pipettes
* Tweezers
* Micro centrifuge tubes

**Introduction:**

All living things are made of cells that together perform specific functions that allow us to live, develop, and grow. All cell contain DNA, a large molecule located inside them that provides the instructions cells need in order to function. Therefore, for something to be considered alive, it must be made of cells that contain DNA. Because the DNA is such a large and important molecule, it is wrapped around proteins and surrounded by a lipid (fatty) membrane inside each cell. Plant cells differ from animals in that they also have a tough cell wall that sounds the outside of the cell that helps give plants their shape and adds an additional layer of protection for the cell and DNA.



Cell wall

Proteins

DNA

Lipid membranes

**Preparation:**

1. Place isopropyl alcohol into a freezer to be chilled until used
2. Prepare the extraction liquid ahead of time by mixing one half teaspoon of salt, one third cup of water and one tablespoon of dishwashing liquid in a glass or small bowl
3. Prepare soybean grounds by grinding up soybeans or soybean seeds by using a coffee bean grinder or other appliance that will grind up the soybeans into fine grounds

**Methods:**

1. Place a tablespoon of soybean grounds small cup
2. Using the transfer pipette, place two full pipettes (10 ml) of extraction liquid into the cup with the soy grounds
3. Using a wooden stir rod, thoroughly mix together the contents of the cup
4. Place a coffee filter into a funnel and put it in a second clear plastic cup
5. Pour your soy liquid mix into the coffee filter and allow liquid to filter into the cup
6. Slowly add 10 mL of chilled isopropyl alcohol on top of the soy liquid

\* DO NOT mix the two layers
\* the layer of alcohol should fully cover the top of the strawberry liquid and be thick enough to see though

1. Allow cup to sit undisturbed on a table and observe white stringy DNA start to be pulled into the alcohol layer
2. Use Tweeters or a wooden stirring rod to gently remove the DNA to observe it
3. Place DNA into a micro centrifuge tube to take with you

**Without premade extraction liquid**

1. Place a tablespoon of soybean grounds small cup
2. Into the cup, add 10 mL of water, 1 mL of dish soap, and a pinch of salt
3. Before the bag is sealed, remove as much air as possible
4. Using a wooden stir rod, thoroughly mix together the contents of the cup
5. Place a coffee filter into a funnel and put it in a second clear plastic cup
6. Pour your soy liquid into the coffee filter and allow liquid to filter into the cup
7. Slowly add 10 mL of chilled isopropyl alcohol on top of the strawberry liquid

\* DO NOT mix the two layers
\* the layer of alcohol should fully cover the top of the strawberry liquid and be thick enough to see though

1. Allow cup to sit undisturbed on a table and observe white stringy DNA start to be pulled into the alcohol layer
2. Use Tweeters or a stirring stick to gently remove the DNA to observe it
3. Place DNA into a micro centrifuge tube to take with you

**How did these steps help us in extracting out the DNA?**

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| --- | --- |
| Procedure | Function |
| Grinding of the soybeans  | Breaks apart the cells |
| Addition of dish soup | Dissolves lipid membranes |
| Addition of salt | Disrupts proteins |
| Straining soybean mixture | Separates components of cells  |
| Addition of isopropyl alcohol layer | Pulls DNA out of solution |