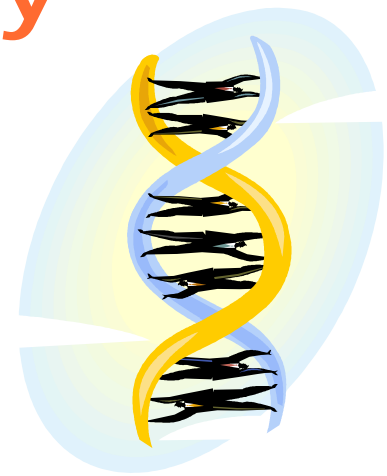
What Exactly Is DNA?



Victorian Essential Learning Standards **Domains and Levels:**
Science 4,5 & 6 and Mathematics-Measurement 3,4 & 5

Duration and Setting

1 hour in the classroom

Summary

This activity enables students to work scientifically to observe DNA - the blueprint for life. This activity may be used to provide background knowledge before students learn about selective breeding, genetic engineering and their places in food production.

Background notes for teachers

Selective plant and animal breeding have been practised for thousands of years. By choosing the best plants or animals to breed, farmers and scientists have developed offspring that are suitable for a range of reasons: their size, shape, taste or suitability to a range of climates. But how does this work? The answer lies within cells.

All living things are made up of cells. **Cells** are often called the building blocks of life, because they contain everything required for life. Some organisms (such as bacteria) are made up of one cell. Other organisms are made up of many cells. For example, humans are made up of an estimated 100 trillion cells!

Within each cell is Deoxyribonucleic Acid, or DNA. **DNA** is a molecule that contains the information or blueprint for living things. In this experiment, clumps of DNA will be visible as white strands or blobs. If we were able to view it closer, DNA would look like a spiral staircase - a double helix.

A **gene** is a section of DNA that contains the message for a particular characteristic, eg. the gene for green eyes. There are between 60,000 and 100,000 genes in human DNA, with a complete set in every cell. **Selective breeding** involves people choosing the traits of a plant or animal, by selecting individuals with those traits to breed. More recently, manipulation of DNA has occurred in science laboratories and is called **genetic engineering**.

Materials

From the supermarket/kitchen:

A DNA source: broccoli, split peas and onion work well

Cold water

A pinch of salt

Dishwashing detergent

Meat Tenderiser (from the spice section of the supermarket)

Rubbing Alcohol (look for ISOCOL in the first aid section of the supermarket). If possible, cool in a container with iced water

Equipment:

A blender
Strainer
Bowl/large jar (to blend water and broccoli in)
Measuring jug (500mL-1L works well)
Chopping board and knife

For each student group:

Small glass jars or test tubes
Toothpicks

Instruction and Student worksheet: Viewing Broccoli DNA

Student Name: _____

What do cow breeding, crime investigations and nutrient-loaded broccoli have in common?

Deoxyribonucleic acid (DNA). DNA is a unique code found in the cells of all living things. By studying DNA we are able to:

Breed cattle that produce more milk

Link people to crime scenes, by proving they were there

Increase the nutrient content of broccoli (so you don't have to eat as much!)

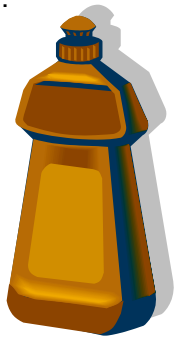
DNA is so important, yet so tiny. How do we know it is really there? This experiment allows you to see some clumps of DNA, without microscopes or other scientific equipment.

In this experiment you will:

1. Physically break up the raw broccoli - with salt and a blender
2. Break the cell and nucleus membranes from the broccoli cells with the detergent
3. Free and uncoil the DNA - with enzymes in meat tenderiser
4. Collect the broccoli DNA - using rubbing alcohol.

The first 3 steps can be completed as a whole class group or prepared before the experiment.

1. Prepare your broccoli soup: add 1 cup of chopped raw broccoli to 2 cups of water. Add a good pinch of salt.
2. Blend for 15 seconds. Strain the broccoli soup into the measuring jug and add 2 tablespoons of dishwashing detergent. Mix gently for a minute.
3. Next, pour the broccoli water into the small glass jars or test tubes to about 1/3 full.
4. Add a pinch of meat tenderiser and gently swirl to mix.
5. Tilt the jar and pour some rubbing alcohol down the inside of the jar/test tube. Pour an equal volume to the amount of broccoli water. (By pouring down the inside of the jar, you avoid mixing the alcohol and broccoli water.)
6. Allow the jar to stand for 3-5 minutes. You should be able to see bubbles in the alcohol layer, then white 'clouds' or strands will form. This is the DNA! Gently swirl the toothpick in the solution to collect the DNA strands.



Discussion Questions:

1. Develop a flowchart, with images and text, showing the steps involved in viewing broccoli DNA.

2. What was the most difficult step? Explain your answer.

3. List 5 other things you could extract DNA from. Would you expect the DNA to look the same or different in each case? Why?