**ACTIVITY: Extracting DNA**

**Activity idea**

In this activity, students will extract the DNA from a tomato.

By the end of this activity, students should be able to:

* undertake a simple DNA extraction process, extracting and observing DNA from a tomato
* describe what DNA looks like
* develop an understanding about the nature of DNA.

# For teachers

***Introduction/background notes***

This activity can follow on from the activities [Introduction to cells](https://www.sciencelearn.org.nz/resources/186-introduction-to-cells) and [Inside a cell](https://www.sciencelearn.org.nz/resources/187-inside-a-cell). Here is a quick background recap:

* All living things are made of cells.
* There are many different types of cells, each with different roles within an organism – for example, muscle cells, skin cells, brain cells.
* Cells get their instructions from DNA, which provides information for the cell to make the specific proteins it needs to carry out all its functions.
* DNA is within the nucleus of (nearly) all cells.

In this activity, students will isolate the DNA of a piece of tomato to see what DNA actually looks like. All living things contain DNA so other fruit and vegetables can be substituted for the tomato. Bananas, kiwifruit, cauliflower, broccoli, spinach or strawberries all provide suitable alternatives. Chicken livers, eggs and other animal products can also be used, but plant cells contain less water and fewer possible contaminants, so plant material is better for this activity.

***How the extraction works***

DNA is a long stringy molecule twisted up into a ball within the nuclei of the tomato cells.

The blender breaks down the plant cell walls and adding detergent destroys the nuclear membranes, causing the release of the nucleic acids (DNA and RNA) from the nucleus.

Salt is added to help the DNA clump together. As DNA dissolves in water, we can’t see it at this stage.

Adding alcohol (ethanol or isopropanol) causes the DNA to clump together further, forming a stringy solid. This process is called precipitation.

The physical force of the DNA clumping together as it precipitates pulls more strands along with it as it rises into the alcohol, becoming visible as a stringy mass.

Although cells with more chromosomes contain relatively more DNA, the difference will not be noticeable in this activity.

One key factor can help with successful DNA extraction – the alcohol (ethanol, isopropanol or methylated spirits) can be kept in the freezer until ready to use. It must stay cold in this activity.

It is important that the temperature is controlled, as once the cell walls are broken, cellular enzymes may affect the DNA. Reducing the temperature reduces enzyme activity and helps the DNA precipitate more quickly.

The method described in this [activity](http://ucbiotech.org/edu/edu_aids/TomatoDNA.html) is based on a method by Petra Frey. Another method of DNA extraction is described on the [Learn Genetics website](http://learn.genetics.utah.edu/content/labs/extraction/howto/).

***What you need***

* Copies of [Extracting DNA from a tomato](#bookmark=id.1t3h5sf)
* 2–3 tomatoes chopped up into small pieces (1 cm or less) 

(Remove skin before cutting up. Each group will need at least a quarter of a tomato. Frozen tomatoes also work well.)

* Liquid hand soap or detergent (containing lauryl sulphate, EDTA and citric acid)
* Salt solution (1 tsp table salt in 850 ml water)
* Cold meths, ethanol or isopropanol (roughly equal volumes of this and the tomato)
* Pipette or small measuring cylinder (to pour small volumes of 2–3 ml)
* Blender

For each group:

* Teaspoon
* Two beakers
* Filter paper
* Two 10 ml measuring cylinders
* Wooden skewer or ice block stick

***What to do***

1. Introduce the activity and explain the concept of DNA.
2. Hand out copies of [Extracting DNA from a tomato](#bookmark=id.1t3h5sf) and discuss.
3. Divide the class into groups and assist students to gather the equipment and materials they need and conduct the experiment.
4. Facilitate the discussion/reflection questions in groups and as a class.

***Extension ideas***

Students can try to experiment with:

* other DNA sources
* different soaps and detergents
* leaving out or changing steps
* varying how much of each ingredient is used.

**For students**

***Extracting DNA from a tomato***

1. Collect a quarter of a tomato in one of the beakers.A picture containing table, indoor, cup, counter

   Description automatically generated
2. Add 2 teaspoons of the salt solution and one squirt of hand soap.
3. Put the mixture in a blender and blend for 5 seconds to create a fine slurry.
4. Strain the well-blended tomato through a filter into another beaker. You may need to squeeze the filter paper gently. This may take a few minutes – be patient.
5. Pour the strained tomato mixture into a test tube or measuring cylinder.
6. Measure (or estimate) the amount of tomato mixture in the cylinder. Add the same volume of cold alcohol (methylated spirits, ethanol or isopropanol) onto the tomato mixture by pouring it very gently down the side of the cylinder using a pipette or another measuring cylinder. The alcohol should float on top of the tomato mixture, but don’t worry if it mixes a bit.
7. Look carefully at the layer between the tomato mixture and the alcohol. You will see a whitish, snotty-looking substance. This is DNA that has separated (precipitated) out of the tomato mixture. Carefully swirl the tube to make more DNA visible.
8. With a wooden skewer or ice block stick, reach in and hook the stringy DNA.

Congratulations, you’re now on your way to becoming a genetic engineer!

***Reflection questions***

1. Within your group, discuss how your results compared with what you expected. Explain your answer and be prepared to share with other groups.
2. What do you think now about the nature of DNA?
3. How did your results compare with those of other groups? Can you explain any differences?