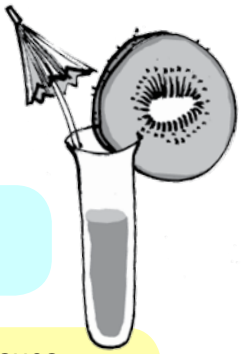
TEACHER'S NOTES DNA COCKTAIL

OVERVIEW

Aimed at key stage 3 & 4 pupils.

This activity outlines a simple method for extracting DNA from food.



LEARNING OBJECTIVES

- DNA is found in all living things
- DNA can be easily extracted from cells

CURRICULUM LINKS

- KS3: Life processes are supported by the organisation of cells into tissues, organs and body systems
- KS4: The ways in which organisms function are related to the genes in their cells

PREPARATION

Gather the following resources:

1. Kiwi fruit (preferably ripe) - 1 fruit between 4 people
2. Zip-lock food bags (1 per pupil)
3. Ethanol (approximately 300ml needed for a class of 30)
4. Salt
5. Washing up liquid (economy brands work best)
6. Water bath
7. Large test tubes (25ml capacity)
8. Sieves (alternatively funnel and filter paper)
9. Chopping boards and plastic knives

- Print worksheets
- Switch on water bath to 55°C
- Decant the ethanol and store on ice
- Prepare the kiwi - peel the skin and chop into quarters (throw the skin away)
- Make the extraction buffer for the class, using:

400ml water 8g salt 40ml washing up liquid

(Stir this mix carefully and try to avoid making too many bubbles in the buffer)

CARE: Ethanol is highly flammable (follow in-house safety guidance)

ANSWERS

a) What did you see when you added the ethanol?

Students should be able to see a white/cloudy layer of DNA between the alcohol and extraction mixture.

b) In which part of a cell do you usually find DNA?

Inside nucleus.

c) How did you release the DNA into the solution?

The cell and nuclear membranes were broken down by physically cutting the cells, using detergent in the extraction buffer and the heat helped to rupture cells too.

d) Why do you think the mixture should be warmed up for 10 minutes?

Warming the mixture allowed the enzyme (proteases) to work, breaking down proteins in the mixture and helping to release the DNA. It also helped to break open the cells

e) Do you think the DNA would look the same if it was extracted from human cells?

DNA will look the same no matter what it is extracted from.

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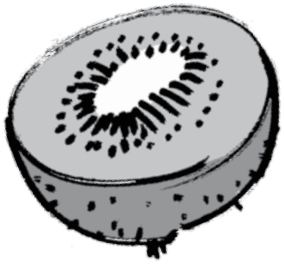
FURTHER information

DNA can be easily extracted from a number of fruit and vegetables by following this simple procedure. It works best with fruits that contain protease such as kiwi, but can be extended for use with other foods by adding some pineapple juice or a pinch of meat tenderiser (there are many websites giving details of this method).

Mashing up the fruit separates the cells and exposes the cell membranes to the washing up liquid. This contains a detergent which breaks down the phospholipid bilayer of the cell membranes and releases the DNA. The salt helps the DNA to precipitate. Sieving the mixture separates out the bulkier pieces of fruit that would make the DNA more difficult to see. As DNA is polar, it is soluble in water but not in ethanol. Adding ethanol causes the DNA to precipitate out of solution, making it visible. The DNA should be visible as a layer of white precipitate between the alcohol and the extraction buffer.



n.b Obviously this is not a cocktail that students should drink!

EXTENSION

A larger investigation could be set up to either:

a) Compare the amount of DNA extracted between different foods (onion also works well, but smells a lot worse)

b) Modify the design of this experiment in a controlled way see what influences the amount of DNA extracted.

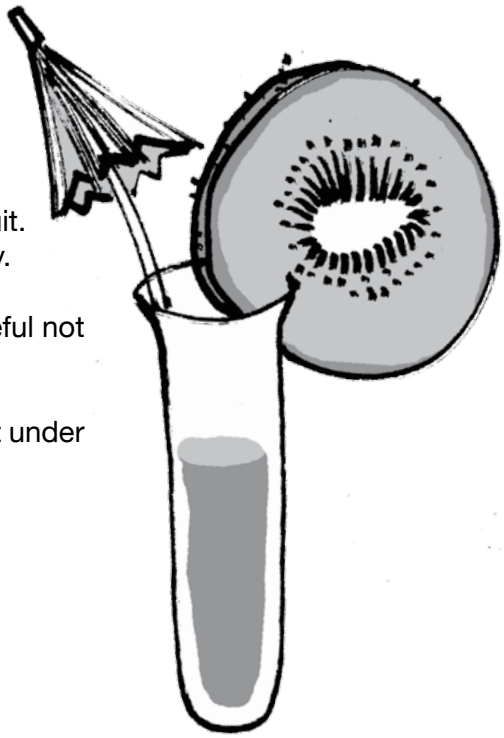
Teachers might enjoy a real DNA cocktail made with strawberries, gin and curacao. It was developed by the NCBE to celebrate DNA 50 and looks stunning in red, white and blue and obviously tastes great too. For further information:

www.ncbe.reading.ac.uk/dna50/cocktail.html

PUPIL WORKSHEET

DNA COCKTAIL

You will be given a quarter of a kiwi fruit



1. Cut the kiwi carefully into small pieces on the chopping board
2. Add the pieces of food into a zip-lock plastic bag
3. Measure 10ml of extraction buffer and add this into the bag with the fruit. Try to remove most of the air and make sure you close the bag securely.
4. Gently mash up your fruit and mix with the buffer for 3 minutes (be careful not to break the bag)
5. Place the bag into warm water (55°C) for 10 minutes (try to keep the fruit under the water to keep it warm)
6. Sieve or filter the mixture to get rid of the big lumps of fruit
7. Transfer the green liquid into a large test tube
8. Gently pour 10ml of cold ethanol down the side of the test tube
9. Look closely between the green layer of kiwi mix and the ethanol on top

a) What did you see when you added the ethanol?

b) In which part of a cell do you usually find DNA?

c) How did you release the DNA into the solution?

d) Why do you think the mixture should be warmed up for 10 minutes?

e) Do you think the DNA would look the same if it was extracted from human cells?