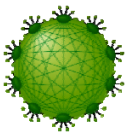

John Schollar and Dean Madden

DNA necklace

Crude extraction of DNA from human cheek cells

National Centre for Biotechnology Education, University of Reading

Aim

This procedure allows the crude extraction of DNA from human cheek cells which can be suspended in a glass vial and worn as a necklace. The DNA extracted by this technique is not pure enough to be used for other purposes such as medical diagnosis or genealogical studies: it is purely a novelty item.

Introduction

The method of isolating DNA described here is a greatly simplified version of the conventional procedures that are used for medical, forensic or other purposes. As written, the procedure is of limited educational value, although it may be modified to include additional steps which would enhance its educational value. The primary purpose is to provide an entertaining activity with an end product that is unique to the individual carrying out the task.

Equipment and materials

Needed by each person

Equipment

1 mL treat pipette, preferably plastic

10 mL measuring cylinder, syringe or similar, for measuring 1 mL volumes

Necklace components: glass vial; metal cap; neoprene rubber plug and a length of neck cord.

1 sterile cotton wood swab

Materials

1 mL DNA extraction buffer
2 mL methylated spirits

To make 1L of blue extraction buffer:

- Add 7.88 g of Tris.HCl to a 1 litre flask
- Add 500 mL water
- Add 100 mL 10% SDS solution
- Add 70 mL 3M NaCl solution
- Add 1 mL of blue food dye
- Swirl gently to mix
- Make up to 1 litre with distilled or deionised water

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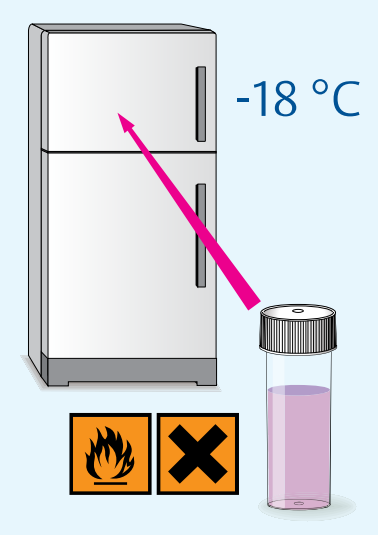

Figure 1

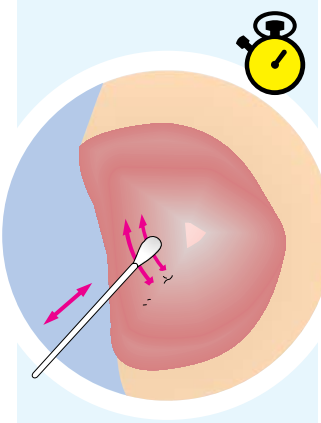

Figure 2

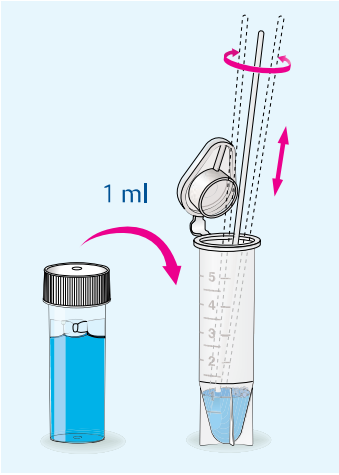

Figure 3

Procedure

Before you start

If you have recently eaten, had something to drink or brushed your teeth, you must wait for three or four hours before starting this procedure. This is because food, liquids or tooth brushing can wash away many cheek cells so that only a very small amount of DNA will be obtained.

Place the methylated spirits (meths) in a sealed container in a freezer at least two hours before carrying out the extraction. It is recommended that the meths is left overnight in the freezer.

WARNING: Methylated spirit is highly flammable. Most freezers are not spark-proof and there is a risk of explosion if meths vapour escapes inside the freezer. Therefore it is essential that the bottle containing the meths is tightly closed before it is placed in the freezer. It is also a wise precaution to chill only small volumes at a time. (Fig 1)

1. Measure one millilitre (1 mL) of the extraction solution into a small test tube or similar container (such as a 5 ml graduated Eppendorf-type tube). The extraction solution contains a detergent, so you may notice bubbles in the liquid.

2. Remove a sterile cotton wool swab from its protective packaging. Swallow excess saliva so that your mouth is not too wet. Rub the cotton wool swab vigourously around your mouth for at least two minutes. Rub the insides of your cheeks and between your gums and cheeks on both the upper and lower jaw and even, gently, below the tongue. The aim is to collect as many cells as possible on the swab, so the more you rub (and the less saliva there is to wash away the cells) the better your results may be. (Fig 2)

3. Place the tip of the cotton wool swab in the extraction solution. Agitate the cotton wool swab vigourously in the liquid for two full minutes to remove the cheek cells. Press the tip of the swab against the side of the tube as you agitate so that cells are washed off into the extraction solution. The detergent in the solution will break open the cheek cells, releasing your DNA. (Fig 3)

4. The next step requires care and a steady hand. Take the ice cold meths from the freezer. Angle both tubes and very carefully pour about two millilitres (2 mL) of meths down the side of the test tube, so that the liquid flows gently onto the top of the extraction solution, forming a separate layer (this is rather like making an exotic multi-layered cocktail). Return the test tube to an upright position, then leave it to stand where it will not be disturbed or knocked over. (Fig 4)

5. Watch and wait for about 10 minutes (if condensation forms on the outside of the tube, you can wipe it away with your finger). DNA from the cheek cells will

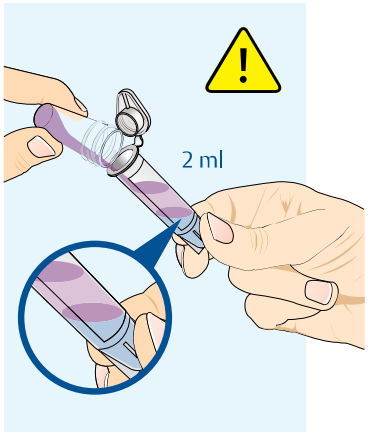

Figure 4

slowly diffuse into the upper meths layer. Salt in the extraction solution makes the DNA fibres stick together to form whitish clumps. These slowly rise to the top of the meths, carried by minute air bubbles which can often be seen surrounding the DNA. (Fig 5)

IMPORTANT: If your cheek cell sample contained a lot of saliva, it may be necessary to wait for longer than 10 minutes. If you do not see any DNA after 10 minutes, leave the tube to stand undisturbed for a few hours (or even overnight). Eventually the white fibres of DNA should appear.

6. Using the plastic pipette, gently remove the DNA and a little of the meths and transfer it into the small glass vial. Do not overfill the vial, as you will need to leave enough space for the rubber plug to seal the tube. (fig 6)

7. Push the small black rubber stopper into the glass vial so that the plug fits firmly and seals the vial. Please remember that the vial is made of glass — apply only gentle pressure so that you do not break it. (Fig 7)

8. Ensure the vial and the rubber plug are dry. Place one drop of glue (such as superglue) onto the top of the plug and rim of the test tube. Push the metal cap over the plug and test tube. When the glue has set the tube can be handled. Cut the neck cord in half. Thread one of the two pieces through the metal cap, tie the two ends of the cord together. (Fig 8)

Your DNA necklace is now ready to wear!

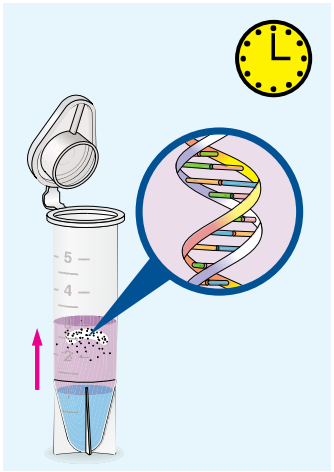

Figure 5

Safety guidelines

Methylated spirits

Methylated spirit is highly flammable. Most freezers are not spark-proof and there is a risk of explosion if meths vapour escapes inside the freezer. Therefore it is essential that the bottle containing the meths is tightly closed before it is placed in the freezer.

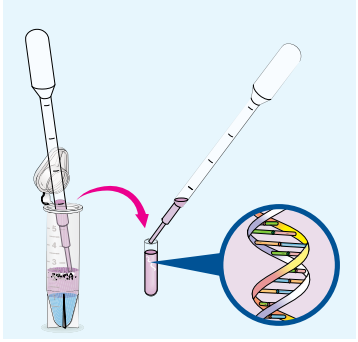

Figure 6

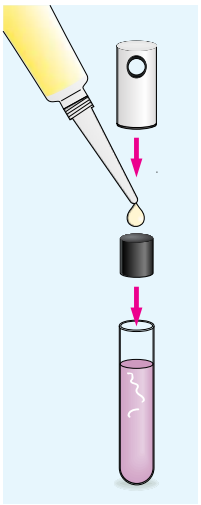

Figure 7

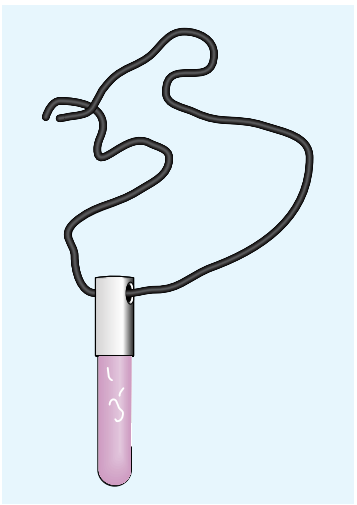

Figure 8

Preparation and timing

This activity takes about 30 minutes. The methylated spirits must be chilled beforehand.

Troubleshooting

Some cheek cell samples contain a lot of saliva, it may be necessary to wait for longer than 10 minutes. If you do not see any DNA after 10 minutes, leave the tube to stand undisturbed for a few hours (or even overnight). Eventually the white fibres of DNA should appear.

Suppliers

The NCBE supplies a complete kit with materials to make two DNA necklaces. Similar arrangements may exist in other countries.

Storage of materials

All materials may be stored at room temperature.

Other sources of information

Web site

Animation showing extraction of DNA (Genetic Science Learning Center, Utah). This shows a more advanced technique.

http://learn.genetics.utah.edu/units/biotech/extraction/

Acknowledgement

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