

DNA

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Acknowledgements

This resource was originally developed by the University of Reading to support outreach work delivered as part of the Chemistry for All project.

To find out more about the project, and get more resources to help widen participation, visit our Outreach resources hub: rsc.li/3CJX7M3.

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Learning objectives

By the end of this session, you will be able to:

- Describe the role of DNA in living things.
- Describe the main processes involved in extracting DNA from plant cells.

Career link

Senior director of chip research

Watch the video job profile on **slide 6** of the PowerPoint to meet Jason, a senior director of chip research at Oxford Nanopore Technologies. He works with other scientists to sequence DNA during viral outbreaks or during the discoveries of new species. The video is also available from rsc.li/3ZMJAh1.

Demonstration: extracting DNA from strawberries

Equipment

- Medium-sized strawberry
- Zip-lock bag
- 10 ml measuring cylinder
- Boiling tube
- Boiling tube rack
- Coffee filter
- Funnel
- 1 spatula/glass rod
- 1 wire hook
- Plastic Pasteur pipette
- Stop clock (or phone)
- Chilled ethanol
- Strawberry extraction solution
- Pineapple juice
- 250 ml beaker

To do

1. Take a medium-sized strawberry, place it in a zip-lock bag and 'squish' it to form a mush.
2. Using a clean 10 ml measuring cylinder add 10 ml of extraction solution to the bag.
3. Reseal the bag and continue to 'squish' for three minutes, making the lumps as small as possible.
4. Place a boiling tube in a boiling tube rack, place a funnel containing a coffee filter in the top of the boiling tube and empty the contents of the zip-lock bag into the coffee filter.
5. Once filtered, remove the funnel and using a pipette add five drops of pineapple juice to the mush in the boiling tube and gently stir the solution with a spatula or glass rod.
6. Tilt the boiling tube to an angle of 45° (this increases the surface area). Using a clean pipette, slowly run chilled ethanol down the side of the tube onto the surface of the strawberry extract until you have a 3 cm layer of ethanol on top of the strawberry solution.
7. Place the boiling tube back in the boiling tube rack and leave to stand. Visible strands of DNA should start to form and rise from the interface between the two liquids.
8. Once the DNA strands have formed, they can be removed using a wire hook.

Activity 1: extracting DNA from kiwi fruit

Equipment

- Kiwi fruit
- Knife (shared)
- 250 ml glass beaker
- Sieve or funnel and coffee filter/filter paper
- 10 ml measuring cylinder
- Spatula or glass rod
- Stop clock (or phone)
- Boiling tube
- Boiling tube rack
- 2 × 50 ml beakers (one for extraction solution and one for ethanol)
- Plastic Pasteur pipette
- Kiwi extraction solution
- Pineapple juice
- Chilled ethanol

Note: keep the kiwi fruit extraction solution and the ethanol in separate beakers. Wash beakers thoroughly if you need to reuse them.

Safety and hazards



Ethanol is highly flammable and can cause eye irritation so wear eye protection and a lab coat, if supplied, to protect your clothes.

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To do

1. 'Squish' the kiwi while in the skin to make it soft. Once completely soft cut off the top of the kiwi fruit using a knife and transfer the pulp into a beaker.
2. Using a measuring cylinder add 10 ml of water to the kiwi fruit pulp in the beaker and stir thoroughly using a glass rod or a spatula.
3. Filter the kiwi fruit pulp solution through a sieve or a coffee filter/filter paper in a funnel into a boiling tube until the tube is one-third full. (Although a sieve is more time efficient, a filter in a funnel works just as well, but is slower. If using a filter in a funnel, gently stir the pulp using a spatula or glass rod to speed up the process.)
4. Transfer some of the kiwi fruit extraction solution to a small beaker and, by eye, add an equal volume of kiwi fruit extraction solution to the kiwi fruit pulp solution in the boiling tube.

5. Using a spatula or glass rod stir gently for one minute to mix, but make sure no bubbles form. Do not apply excessive pressure to the glassware when mixing to avoid cuts from broken glass.
6. Pour 20 ml of chilled ethanol into a clean small beaker. Tilt the boiling tube to produce a larger surface area. Using a Pasteur pipette, slowly run the ethanol down the side of the boiling tube. Continue adding the ethanol until you have a 3 cm layer of ethanol on top of the kiwi solution.
7. Place the boiling tube back in the stand and watch the strands of DNA form between the two layers. These rise to the top of the upper ethanol layer.

You will now repeat the experiment, but this time you will add pineapple juice to see if it makes any difference to the amount and quality of DNA extracted from the kiwi fruit.

1. 'Squish' the kiwi while in the skin to make it soft. Once completely soft cut off the top of the kiwi fruit using a knife and transfer the pulp into a beaker.
2. Using a measuring cylinder add 10 ml of water to the kiwi fruit pulp in the beaker and stir thoroughly using a glass rod or a spatula.
3. Filter the kiwi fruit pulp solution through a sieve or a coffee filter/filter paper in a funnel into a boiling tube until one-third full. (Although a sieve is more time efficient, a filter in a funnel works just as well, but is slower. If using a filter in a funnel, gently stir the pulp using a spatula or glass rod to speed up the process.)
4. Transfer some of the kiwi fruit extraction solution to a small beaker and, by eye, add an equal volume of kiwi fruit extraction solution to the kiwi fruit pulp solution in the boiling tube.
5. Using a plastic Pasteur pipette, add two full pipettes of pineapple juice to the mixture in the boiling tube and mix thoroughly using a spatula or glass rod.
6. Pour 20 ml of chilled ethanol into a clean small beaker. Tilt the boiling tube to produce a larger surface area. Using a Pasteur pipette, slowly run the ethanol down the side of the boiling tube. Continue adding the ethanol until you have a 3 cm layer of ethanol on top of the kiwi solution.
7. Place the boiling tube back in the stand and watch the strands of DNA form between the two layers. These rise to the top of the upper ethanol layer.

Questions

(a) Why is it important that the fruit is 'squished' at the start of the experiment?

(b) How did the amount of DNA extracted from the kiwi fruit compare with the amount extracted from the strawberries? Why do you think this was?
