

Student Activities

DNA Extraction

Introduction

The foundations of biotechnology are some of life's most important biological processes. These processes are cell division, replication, and recombinations of genetic material; and they have been on-going since life began. Deoxyribonucleic acid (DNA) is the primary genetic material for these biological processes.

Purpose

To extract and separate DNA from a living organism.

Materials

- 1 small to medium sized onion
- dish detergent
- NaCl (table salt)
- water (distilled or tap)
- 95% ethyl alcohol
- refrigerator
- centrifuge (optional) or stoppered test tube
- clean beaker (250 ml)
- water bath (55 degrees Celsius)
- wooden splint or shish kabob stick

Procedure

1. Peel the onion and then dice it suitable for stir frying. Place in beaker.
2. Add 15 ml of dish detergent.
3. Add 1 - 2 ml of salt (dry measure).
4. Add 100 ml of water then stir the mixture well while gently crushing the diced onion in the newly made suspension.
5. Place the suspension in a 55 degree Celsius water bath. Stir the mixture continuously for 5-10 minutes. Stirring longer than 15 minutes leads to thermal break down of the DNA.
6. Transfer 10 ml of the liquid part of suspension to a stoppered test tube or centrifuge tube.
7. Add 10ml of cold ethyl alcohol and gently invert the test tube several times to allow mixing of the alcohol and the suspension containing the extracted onion DNA .
8. Place the tube in the freezer or on ice for 3-5 minutes to precipitate the DNA. If a centrifuge is available, balance the rotor and spin at 6000 rpm for five minutes.
9. If the separation went well, the DNA can be seen as a white deposit on the surface of the test tube or centrifuge tube. Use a splint to scrape the DNA out of the tube for closer inspection.

This is a hands-on activity suggested by the Saskatchewan Agricultural Biotechnology Information Centre (SABIC), an organization whose purpose is to help educate students and the general public about biotechnology.

Notes for the teacher

The function of the dish detergent is to dissolve the fat layers which make up the cell and nuclear membranes. Any brand of dish detergent will do.

The NaCl dissolves in water to form Na⁺ and Cl⁻ charged ions. DNA is slightly negatively charged on the surface. Because oppositely charged ions attract each other, the sodium (Na) ions attract the tiny invisible threads of DNA. The result is that the threads of DNA become bound to the (Na) ions to form clumps of DNA. These clumps of DNA can be seen with the naked eye.

The hot water bath speeds up the ability of the soap to break down the cell and nuclear membranes and thus release the DNA. However, if the DNA is left too long, it will break down as well.

Examining the recovered DNA

Once the DNA has been recovered, remember that it is not a pure substance. It is a mixture containing supporting proteins which are part of the physical make up of chromosomes.

Have students observe the macroscopic properties of colour and texture.

Have students research the structure of the double helix.

Observe the effects of the stain on the recovered onion DNA under the microscope and compare to that of stained onion skin cells.

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Other Student Activities

Suggested Audience

Biology 30
Plant Science
Technology

1. *Development of Plants*

A kit from Paul Williams, Wisconsin - Fast Plant (see resources) of *Brassica rapa* shows the rapid cycle of plants.