Practical 9 - The extraction of DNA from onions

This practical focuses on setting up and manipulating apparatus and making observations. Further skills can be developed using additional information after the practical has been completed.

Intended learning outcomes

By the end of this practical you should be able to:

- Experience simple techniques to extract DNA from living material.
- Further your knowledge about the structure of DNA

Safety Information

	You should wear eye protection throughout this practical.
	Protease is **harmful**. Avoid contact with eyes or skin.
	Ethanol is **highly flammable**. There should be no flames in the same room.

Background information

- DNA is a polymer made up of monomers called nucleotides
- A gene is a set of coded instructions made up of a particular order of nucleotides
- A nucleotide consists of three parts:
  - i) a pentose sugar
  - ii) a nitrogen containing base
  - iii) a phosphate group
- DNA molecule is a double helix held together by hydrogen bonds between the complementary base pairs

You will investigate how DNA can be extracted from living material such as onion.

- Read the information above
- Read your text book and notes on DNA

Method

Preparations and making observations

1. Prepare the degrading mixture by adding 3g of sodium chloride (table salt) to 10cm^3 liquid detergent (washing up liquid). Make this up to 100cm^3 with distilled water and stir well to ensure the salt has dissolved.
2. The onion should be chopped into small pieces and added to the detergent

solution and stir.

3. Place the beaker into a water bath maintained at 60oc for fifteen minutes.
4. Immediately cool down the onion mixture in an ice cold water bath for five minutes again stirring frequently.
5. Blend using a food blender for no more than five seconds.
6. Using coffee filter paper (laboratory filter paper not coarse enough) filter the mixture into a new beaker.
7. Once you have obtained enough liquid pour 10cm^3 into a boiling tube and add 2 – 3 drops of a protease enzyme and shake the tube to mix the contents well.
8. Pour 10cm^3 ice cold ethanol slowly into the boiling tube and place the tube into rack for about five minutes.
9. DNA should appear where the two liquids meet.

Write-up

- Write up the method and answering the following questions

1. What effect would the washing up liquid (detergent) have on the cell membranes?
2. Why was the beaker placed in a hot water bath for 15 minutes and then immediately cooled?
3. Why was the mixture blended, but only for 5 seconds?
4. What type of enzyme would now be needed to separate the DNA into smaller pieces?

Practical 9 - Lesson Plan

The extraction of DNA from onions

Context

A practical investigation **s**et in the context of 9700 syllabus **–**

Key aims of the lesson

This practical is designed to develop the skills of observation and manipulation of apparatus.

Intended learning outcomes

By the end of the practical and the write-up the student should be able to

- Experience relevant methods.
- Describe and explain the reasons behind the methods.
- Extend knowledge on the structure and function of DNA.

Resources required

White board or flipchart and suitable pens or blackboard and chalk

Practical materials specified on the Technical Information Sheet.

Copies of the student worksheets.

Planned activities

Timings/ minutes	**Teacher/ Student Activities**
End of previous lesson	**Preparation –** Student worksheet given out for students to read in preparation for the practical lesson. To consider the structure of DNA and reinforce previous learning
0 - 3	**Introduction** to the aims, intended outcomes and shape of the lesson – teacher led oral presentation
3 - 5	**Context –** review of DNA structure, key points written on board
5 - 8	**Introduction to method –** Teacher briefly outlines method and answers any student questions on procedure. Teacher emphasises safety concerns with sharp knives and use of ethanol
8 - 45	**Carrying out the practical –** students carry out the practical work. Whilst they are waiting for the 15 minute period they can write up the first part of the method and consider the questions.
40 - 50	**Obtain results –** Students observe DNA produced then clear away apparatus as soon as they have finished

50 - 60	**Drawing together the threads –** Teacher led discussion on the skills that have been developed as well as discussion on results obtained. Practical write up to be completed in following lesson or as homework activity

Useful information

- Other vegetables/fruit can be substituted for onions, however mixed results are often obtained.

Discussion / evaluation points should include:

- explanation of the methods used
- possible problems with the method

Practical 9 - Technical information

Extraction of DNA from onions

The apparatus and materials required for this practical are listed below.

The amount of apparatus listed is for one student or one group of students if they are to work in groups.

1. fresh onion, approximately tennis ball sized
2. sharp knife
3. chopping board
4. 2 x 250cm^3 beakers
5. 1 x 400cm^3 beaker or jug (for the ice)
6. 3g salt
7. 10cm^3 washing up liquid
8. 90cm^3 distilled water
9. (Thermostatically controlled) water bath at 60°C.
10. Supply of ice
11. Food blender (household domestic one is ideal)
12. Coffee filter paper
13. Funnel
14. Boiling tube
15. 2-3 drops of protease enzyme, such as neutrase ®
16. 10cm^3 ice cold ethanol

SAFETY NOTE

The ethanol must be ice cold, this involves leaving it overnight in a freezer. It is essential that it is placed in a sealed, vapour tight plastic bottle. If this is not possible put the ethanol in a sealed container in an ice bath for several hours before the practical is due to start.

Safety Precautions/Risks.

Protease = H 

Ethanol = F 

A risk assessment should be carried out as a matter of course.