Preparation for orangutan activity

Overview

This activity has been designed to introduce the practical technique of micropipetting and the scientific skills of observation and results interpretation to students at Key Stage 3 in a manner that minimises Health and Safety considerations, whilst placing the skills in a relevant context.

Preparation

This guidance for preparation is divided into two parts:

1. Advanced preparation: activities that can be done several days in advance
2. Prior preparation: preparation required immediately prior to the session

The instructions in Table 1 give the equipment and reagents required for a pair / group of students. You will need to increase the amounts to suit the number of pairs that you are teaching.

Note: *C denotes an item that is shared amongst the class and *2 denotes an item that is shared between 2 pairs or groups.

Laboratory	Advance preparation	Prior preparation
Orangutan activity	Prepare 50% glycerol solution. Aliquot: • 8.5 µl of 50% glycerol, labelled 'O' (offspring) • 8.5 µl of 50% glycerol, labelled 'M' (mother) • 8.5 µl of 50% glycerol, labelled 'F1' (possible father 1) • 8.5 µl of 50% glycerol, labelled 'F2' (possible father 2) • 12 µl of blue food dye, labelled 'LD' Prepare 1% agar-agar gel (0.3g of agar-agar powder/100 ml water). Allow to set in gel tray, double-combed, then cut in half and submerge in water within a petri dish. Draw final results using a pink highlighter on clear OHP sheet (we also laminate ours, so the colour doesn't run / rub off). Dilute SB buffer Pour a 0.8% agarose gel using 1x SB buffer for demonstration purposes Aliquot dye solutions S1, S2 and S3 (from lab 1) for demonstration purposes.	Prepare benches with: • Orangutan activity sheet • P-20 micropipette • Pipette tips • Microfuge tube rack • Microfuge tubes of 'DNA' labelled 'O', 'M', 'F1', 'F2', and the 'loading dye, labelled 'LD' • Waste container • Gloves and goggles • 1% agar-agar gel submerged in water in a petri dish • Black paper to go under petri dish • Vortex *C • Microfuge *C • Biorad electrophoresis tank, containing 1 x SB buffer and a 0.8% agarose gel for DEMO *C • Aliquots of dyes S1, S2 and S3 to load onto agarose gel for demonstration *C • Powerpack *C • UV transilluminator *C • 'Final results' gel *C

Table 1. Preparation for orangutan activity.

The processes for diluting SB buffer and preparing agarose gels are covered in the overview of preparation section on page I10 of the Teacher and Technician guide.

You are expected to provide the glycerol and blue food dye for this lab. We can provide you with agar-agar powder, SB buffer and agarose. Table 2 gives a brief summary of the quantity of reagents required by each pair of students for this laboratory.

Tube contents	Tube label	Aliquot (µl)	Actually used (µl)
50% glycerol (Offspring DNA)	O	8.5	8
50% glycerol (Mother's DNA)	M	8.5	8
50% glycerol (Possible father 1's DNA)	F1	8.5	8
50% glycerol (Possible father 2's DNA)	F2	8.5	8
Blue food dye (Loading dye)	LD	12	8

Table 2 Aliquotting reagents for Orangutan activity.

All of these reagents should be kept at room temperature.

Health and safety

It is assumed that all students follow general laboratory safety precautions including: tying back long hair; not eating or drinking in the lab; keeping lab benches clear of clutter; clearing up spills immediately; handling materials and equipment with care, and; washing hands with soap after completing lab work.

The work that students complete (aliquotting reagents, loading gels and analysing results) has NO Health and Safety implications. This is outlined in Table 3.

Labelled	Contains	Risk assessment
'DNA samples': 'O', 'M', 'F1' and 'F2'	30% glycerol, made up in water	Glycerol is a sweet-tasting sugar alcohol, used as a sweetener in some food manufacturing processes. Not harmful.
'Loading dye': 'LD'	Blue food dye	Sold for consumption, may turn hands blue, but not harmful.
'Agarose gel'	Made with 1% agar-agar powder in water	Agar-agar powder is sold as a gelling agent for consumption. Not harmful.
'electrophoresis buffer'	Tap water	Safe for consumption. Not harmful.

Table 3 Health and Safety information for student part of Orangutan activity.

For the teacher demonstration of loading dyes separating by electrophoresis, the specific Health and Safety information is outlined in Table 4.

Substance / procedure	Hazard	Precautions
Dye solution 1 (S1)	Low hazard, but stains skin.	Use good laboratory practice to avoid contact with skin.
Dye solution 2 (S2)	Low hazard, but stains skin.	Use good laboratory practice to avoid contact with skin.
Dye solution 3 (S3)	Low hazard, but stains skin.	Use good laboratory practice to avoid contact with skin.
Sodium borate (SB) buffer	The presence of the borate means this solution (provided at 10x concentrate) is classified as hazardous to health. Specifically it may damage fertility and may cause harm to the unborn child. Diluting to 1 x SB buffer makes it low hazard.	When handling, wear eye protection (safety glasses are sufficient) and chemical-resistant gloves. Dilute before student use. A 1 x solution is low hazard, but as a precaution students should wear eye protection and gloves when handling the solution.
Agarose gel	Agarose is safe, but will be melted in 1 x SB buffer, so an agarose gel is low hazard.	An agarose gel made with 1 x SB is low hazard, but as a precaution students should wear eye protection and gloves when handling.
Gel electrophoresis	Access to liquids carrying a 130 V current. Access to a metal contact which is live at 130 V.	The electrophoresis chamber cuts off the electric supply whenever the lid is removed. All connections are plastic coated.

Table 4 Health and Safety information for teacher DEMO during Orangutan activity.

Learning objectives

By the end of this laboratory students should be able to:

- Use a micropipette correctly
- Explain the importance of a micropipette
- Understand that gel electrophoresis can separate DNA by size using an electrical field
- Interpret the results of DNA profiles from gels

These learning objectives help to address: the basic structure and size of DNA; how DNA is manipulated using a micropipette; how charged molecules can be separated by agarose gel electrophoresis, and; how to interpret DNA profiles generated by agarose gel electrophoresis.

Prior knowledge and skills

It is helpful if students already know:

- The structure, size and role of DNA
- That DNA is inherited from both parents
- That charged objects, including molecules, move through an electric field

Additional resources

After this lab was created there was a story in the newspaper about an occasion on which this exact scenario occurred. The story can be found at:

https://www.catersnews.com/stories/animals/cute-orangutan-clutches-his-mum-but-whos-the-daddy/