

EASTER BUSH SCIENCE OUTREACH CENTRE

Get hands-on
with real-life
science

See DNA Researcher Guidance

Learning level Primary: P5-7; Secondary: S1-5 (adaptable)

Research themes Body systems and cells
DNA & genes
Inheritance

Duration 20-50min (adaptable)

See DNA overview:

See DNA will allow pupils to do some hands-on DNA extraction from strawberries in the classroom. Depending on learning level, pupils will explore what and where DNA is and inheritance. These themes will be put into context using real scientific research as an example of how these ideas are used in the workplace and inform pupils about the cutting edge research occurring in Scotland. See DNA can be adapted as a tabletop activity without the associated presentation. **This activity can and should be adapted to your own research and themes – get creative!**

Please note that some pupils may be allergic to strawberries. You must ask the school to make you aware of any pupils with a strawberry allergy before you come to school. Banana or kiwi fruit can be substituted for strawberries in these cases.

Learning objectives

P5-P7

- To understand that living things are made of cells
- To understand that DNA is a recipe for life
- To recognise that scientists can use DNA to answer scientific questions

S1-5

- To understand that DNA is present in the nucleus of nearly every cell and is structured into 23 chromosomes.
- To recognise that genes are present as two alleles on each pair of chromosomes and are inherited.

- To understand that DNA can be isolated and used for scientific research using techniques like DNA sequencing.

Before the activity:

- Contact the school to ask whether any pupils have a strawberry allergy.
- Familiarise yourself with the activity protocol and suggested timings below.
- Adapt the activity powerpoint presentation, inserting some information about yourself and your research in the appropriate places.
- Complete the attached template risk assessment and send to the school, the Health & Safety team (ros48@exseed.ed.ac.uk) and the EBSOC team (eb soc@ed.ac.uk).

Activity protocol

Exercise	Description	Timing
Introduction	Using the slides provided, introduce the class to concepts surrounding what DNA is and where it can be found in the cell. Explain that DNA is a part of (nearly) all living things. In primary classes, use the supplied objects and the whiteboards to classify living vs non-living things. In secondary classes the whiteboards can be used where indicated.	10-15min
	Explain the relationship between genes, alleles and chromosomes, emphasising that one chromosome from each pair is inherited from the biological mother and father.	
	Use these concepts to explain genetic inheritance of traits.	
DNA extraction	Ask pupils to get into groups of three or four, with a maximum of 10 groups. Using the slides, talk through the extraction protocol, asking students to wait at the end of each step for you to demonstrate. Ask the class to get into pairs and come up to the front to collect the equipment they will need.	10-20min
	Work step-by-step through the extraction protocol. When you reach the precipitation step, give pupils a verbal warning about the dangers of working with ethanol and ask pupils to come to the front of the class to add the ethanol and demonstrate. Ensure that pupils are wearing gloves and safety glasses before contact with ethanol.	
Wrap up	Explain that extracting DNA is not only just for fun, but the range of scientific investigations we can perform using DNA from genotyping to sequencing. Use examples from your own research if you can, but we have provided some in the slides.	5-10min
	Take any questions the class might have and ask pupils to return unused equipment. Ask the class to dispose of gloves and all used lab	

equipment in the autoclave bag and strawberry mixture into the Winchester provided. If the school has lab sinks, the strawberry mixture can be disposed of in these with plenty of water.

The timings above and associated slides are a guide only – you can adapt these to the time available, or learning level of pupils you are working with.

DNA extraction protocol

Prepare the extraction solution:

1. In a falcon tube add 5ml washing up liquid to 45ml water add $\frac{1}{4}$ teaspoon salt and mix until dissolved

For primary school audiences, you can make up the extraction solution in advance, depending on time available. Ask pupils to make up as many falcons of extraction solution as there are tables.

DNA extraction

1. Take a strawberry and remove the green top
2. Seal the strawberries into a sandwich bag and pulp with your fingers for a minute
3. Add two tablespoons of the extraction solution into the bag, reseal and mix with your fingers for a minute or two
4. Take a piece of gauze and strap it over the top of the specimen cup with an elastic band
5. Pour the mashed strawberry mixture into the prepared filter and let the liquid drip through into the cup
6. Take a dropper full of the strawberry liquid and transfer to a test tube

Before beginning the ethanol step, ensure that all pupils have gloves and safety glasses on. Tell the class the dangers of using ethanol and invite them up to the front in their pairs when they are ready to perform the ethanol step under supervision.

7. Add a layer of ethanol on top of the strawberry mixture by gently pipetting the alcohol down the inside wall of the tube. Try not to let the two solutions mix!
8. Let the tube rest for a minute until a white stringy substance forms in the ethanol layer – **this is DNA!**
9. Spool the DNA onto the end of an inoculating loop and place onto your strawberry DNA card. Leave this to air dry for a minute before taking away.
10. Ensure that all lab waste is disposed of in the autoclave bag and strawberry mixture is disposed of in the Winchester provided, before taking this back to EBSOC.

Once you return to EBSOC, ensure that the autoclave bag is disposed of appropriately and the contents of the Winchester disposed of down the sink with plenty of water. Please wash out the Winchester, specimen pots and test tubes and leave on the draining board to dry. Replenish all consumables used.