Get hands-on with real-life science

Opening a Can of Worms

Animal Behaviour Toolkit

Teaching Guide

A classroom resource for teachers to support and encourage scientific investigation and to reveal real-world animal behaviour science

THE UNIVERSITY of EDINBURGH
Easter Bush
Science Outreach Centre

Introduction

Who are we?

The Easter Bush Science Outreach Centre (EBSOC), located next to The Roslin Institute on The University of Edinburgh's Easter Bush Campus, is a purpose-built lab where primary and secondary pupils engage with real-life science.

EBSOC enables school pupils to experience real scientific techniques, perform investigations and explore current research happening across The University of Edinburgh, including at The Roslin Institute.

We also support teachers, who teach STEM subjects, and support the Developing the Young Workforce initiative in a variety of ways.

We offer several primary school workshops, details of which can be found at www.ebsoc.ed.ac.uk

All of our workshops are:

- Full-day
- Hands-on
- Curriculum-linked

They provide:

- Real-world connections – actual lab equipment, a chance to meet scientists and vets
- Tangible results – working with real reagents e.g. DNA, bacteria
- Inspiration – for studying STEM subjects at school and beyond

We have designed this teacher toolkit as a classroom resource for teachers to support and encourage scientific inquiry in their own classrooms and to reveal real-world science happening across the University of Edinburgh's Easter Bush Campus.

We hope you enjoy using it, please share your scientific investigations with us by tweeting @EBSOClab #BehaviourToolkit

Good luck,

Jayne Quoiani

Easter Bush Science Outreach Centre Education Officer

What is this toolkit for?

Pupils are engaged and motivated when they are involved in planning their own science investigations. This toolkit will support you in using and teaching the scientific method, in a multitude of different ways (lots of investigations are possible). Using the kit, you can help support your learners to create and carry out their own unique investigations.

The Animal Behaviour Toolkit includes:

- Pupil Experiment Booklet
- Teaching Guide
- Class Presentation
- Experimental materials - all of these materials are easy to source if you wish to gather them yourself.

We have also created a "Real-Life Research Fact File", which can be used to talk about the real-world science that is happening on The University of Edinburgh's Easter Bush Campus, one of which is included in the pupil investigation booklet.

What do I need to remember about carrying out a scientific investigation?

The first thing is to help your pupils create a SMART question! Pupils in P5 and above can work in small groups to do this (4 per group is a good number for cooperative learning), pupils from P1 – P4 can work as a class to come up with one SMART question.

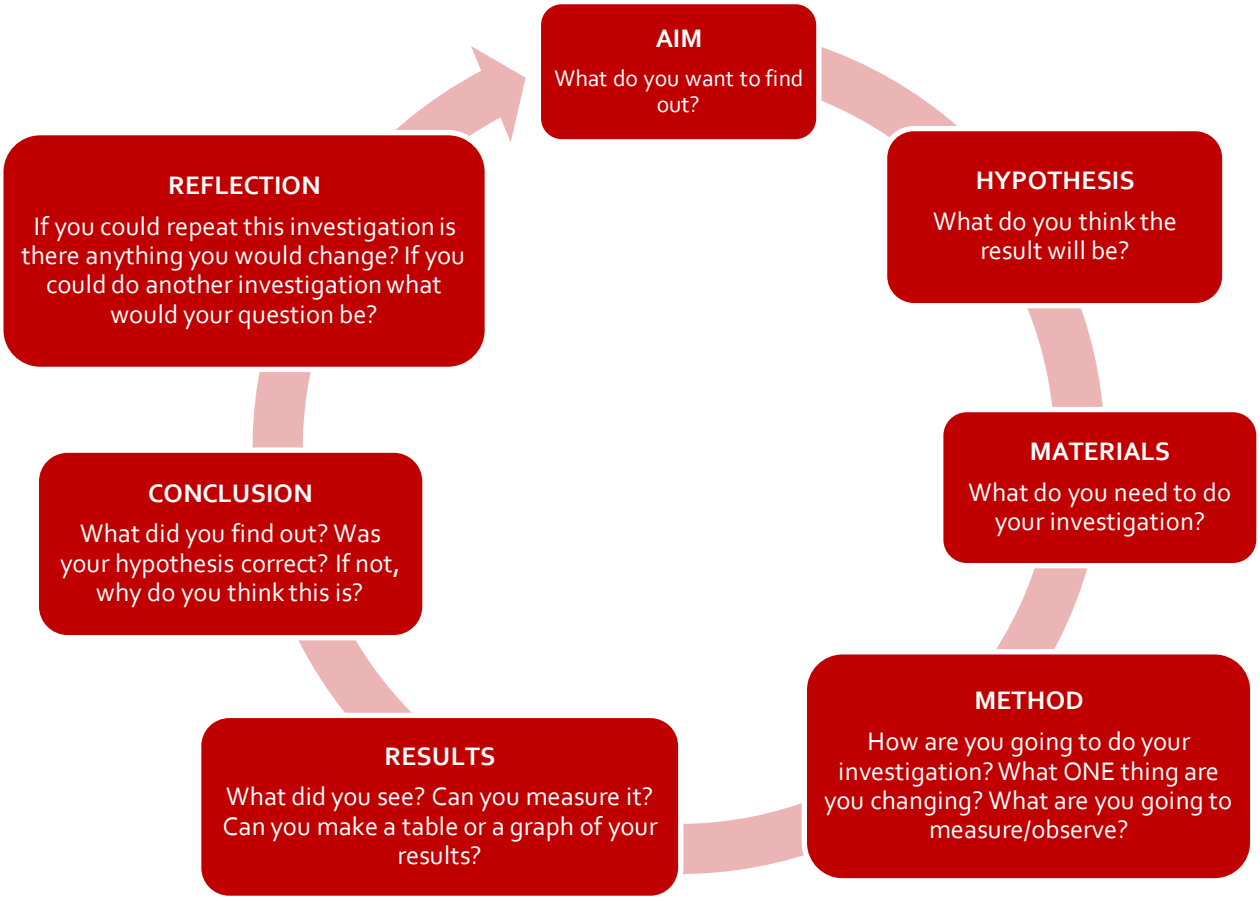
A SMART question is:

- S- Specific - Good investigations are about changing one thing to see what the effect is on another thing i.e. dependent/independent variables
- M- Measurable – Can you measure it*? i.e how far something grows/moves, the time it takes for an animal/person to react/cross a line, the number of times*; or Can you observe it*? i.e defining a pattern, comparing and contrasting*
- A-Achievable - Can it be done in a reasonable time period? Do you have the materials to hand? Are they cheap enough to buy?
- R- Relevant - Is the question subject age/curriculum relevant?
- T – Testable - Is the investigation safe? Is the investigation ethical?

We have suggested some SMART questions in the section *Investigating Animal Behaviour*.

The second thing you need to remember is the scientific method! The key to all good scientific inquiries is the structure. We have supplied a pupil investigation booklet that includes sections for each stage of the scientific method.

The stages of the scientific method are:



Health and Safety

Before carrying out any practical activity, please ensure that this investigation is compatible with your school's risk assessment procedure. Your school may wish you to carry out a full risk assessment before starting any work.

For working with earthworms the main points to consider are:

- After handling worms and/or soil wash hands thoroughly with soap and hot water.
- Worms should be kept moist using a fine-mist water spray and kept in the dark as long as possible. They should not be handled and kept in the light for more than 20 minutes at a time.

Ethical Issues

It is important to introduce the worms to the class as living animals, they should be kept in conditions as close to their natural habitat as possible and any worms kept in a wormery should be released after a maximum of 1 month. Any worms collected for the investigation should be returned to their original habitat.

All investigations should ensure that the worm is not distressed, injured or killed. We have included a guide from Understanding Animal Research to help the pupils to plan an investigation that is ethical and considers the welfare of the worm.

How do we care for the worms?

Like all living things, worms need air, water and food.

- **Food**: Feed them vegetable ends and peelings, but do not give them citrus fruits, onions or garlic.
- **Temperature:** Avoid extremes of cold or heat. Keep the worms indoors in a dark area, a cupboard is a good place.
- **Water:** Keep the soil moist by spraying it with water. The soil should not be too wet or too dry. To check if it is a good consistency pick up a handful and squeeze it, no water should drip out. When you open your hand the soil should keep its shape, if it crumbles the soil is too dry.
- **Housing:** Worms can be kept in a wormery, these can be purchased or made in the classroom. To remove the worms from a wormery it is best to tip out the entire contents into a tray, replacing the soil and worms afterwards and covering with a layer of soil.

To collect worms from an outdoor space you can find some tips from the Nuffield Foundation https://www.nuffieldfoundation.org/practical-biology/observing-earthworm-locomotion . Alternatively you can buy worms online from a range of different suppliers.

Investigating Animal Behaviour

Opening a Can of Worms

Introduction

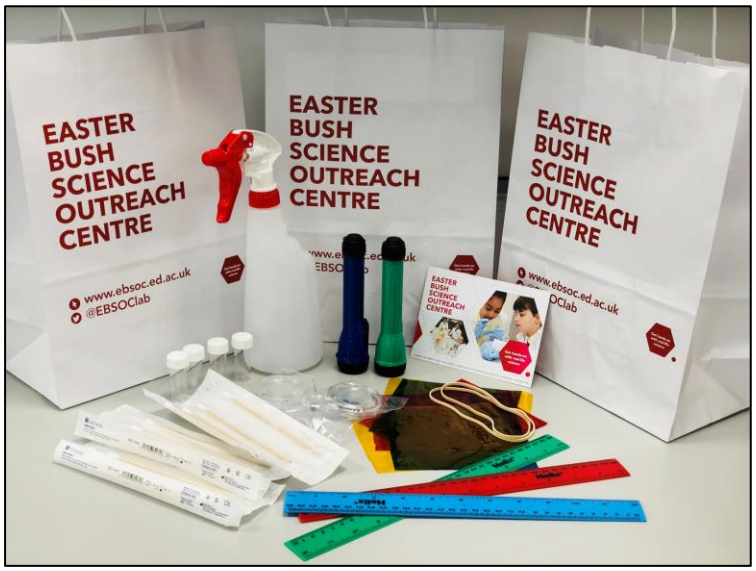
The study of animal behaviour is important for many reasons. Animals give us companionship, help us do work, provide us with food and clothes and they help us to study disease and to make new medicines. There are more than 70 billion farm animals raised for meat and other food products across the world every year, and as the human population continues to rise so does our demand for farm animals. Some of the researchers on the University of Edinburgh's Easter Bush Campus study the science of farm animal behaviour to help our understanding of what our farmed animals need in order to live comfortable lives. The study of animal behaviour in the classroom also provides opportunities for teaching pupils about the process of doing science using the scientific method.

In this teacher toolkit, we will provide some examples of investigation topics, give you some tips on how to support your learners and give you the opportunity to create your own investigations with your pupils.

If you use this toolkit please show us your work by Tweeting @EBSOClab # BehaviourToolkit

Materials included

- 2x torches
- Rubber bands
- Coloured cellophane
- Small Vials
- Swabs
- 3x rulers
- 2x magnifying glasses
- 1x Water spray bottle



Materials not included:

- Worms
- Box or tray
- Soil
- Card or equivalent to cover tray
- Batteries (2 x AA for each torch)

Additional Resources

Pupil Experiment Booklet	To download printable copies of this resource visit www.ebsoc.ed.ac.uk and follow the links to Classroom Resources > Teacher Toolkit

Earthworm Fact file

What are worms? Worms are animals, they don't have backbones (they are invertebrates) and they are cold-blooded (i.e. they cannot regulate their own body temperature).

How many types of earthworm are there? There are lots of different types of earthworm - in Britain alone there are 13 different commonly found types or species. To discover which earthworms you have collected, use the handy Soil and Earthworm Field Guide Key to Common British Earthworms from OPAL.

Are earthworms important? Yes, they are one of Earth's best decomposers, feeding on decaying plant matter and returning the nutrients to the soil. Worms also turn the soil as they move through it, which is very important for plants, and other living things growing in the soil such as microorganisms. Earthworms could be described as **soil engineers**.

Do worms breathe? Yes, they breathe through their skin, they don't have lungs like humans do. It is important for their skin to be moist to be able to breathe.

Do worms have noses? No, they do not have noses but they have chemoreceptors that can react to chemicals.

Do worms have eyes or ears? No, they do not have eyes or ears but they have receptors on their bodies that are sensitive to light and vibrations.

Do worms have mouths? Yes, they have a mouth at one with no teeth. They have a digestive system that processes the food, similar to our digestive system.

Do worms have a heart? No, they don't have a heart but they do have a circulatory system and something similar to a heart called the aortic arch. If you look closely near the head of the worm, you can see the blood moving through the aortic arch - look for a wave of the segments.

Do scientists study earthworms? Yes, over 100 years ago Charles Darwin studied earthworms, and today scientists are still studying them as they are very important for soil quality and have a big influence on plant growth.

Do scientists on the Easter Bush Campus study earthworms? No they don't, but many scientists on the campus study animal behaviour in livestock animals such as pigs, chickens, quails and cows. Many of the same principles apply to studying animal behaviour, whatever the size of the animal!

What questions can my pupils ask?

This investigation is an ideal opportunity for creative thinking and there are many questions that your pupils could ask and investigate safely with worms. We've come up with some examples below, but please don't be limited by them.

1) **How long is a worm?**

   Pupils use the ruler to measure the length of their worms. They record all of their results and calculate the average length. Please ensure that the worms are handled for a minimal time and that they are handled very gently.

   Teaching prompts: *How long do you think the worm is? What are the best units to measure in?*

2) **Do worms prefer wet or dry soil?**

   Cover half the tray with dry soil and the other with wet soil, place the worm on the boundary so that it can feel both soils. Cover with the card and wait for 5 minutes. Record the outcome.

   Teaching prompts: *How will you know if the worm prefers wet or dry soil? Can you measure this? Is it important to test more than one worm?*

3) **Do worms prefer light or dark?**

   Using the torches and a piece of card, cover half of the tray with the card and shine the torch on the other half. Place the worm on the boundary. Record the outcome.

   Teaching prompts: *How will you know if the worm prefers light or dark? Can you measure this? Is it important to test more than one worm?*

4) **Do worms react to coloured light?**

   Using the torches and coloured cellophane attached to end of the torch, pupils can test if the worms react differently to red, blue and yellow light. Record the outcome.

Teaching prompts: *How will you know if the worm reacts to the different colours of light? Can you measure this? Is it important to hold the torch the same distance away each time? Is it important to shine the torch for the same amount of time? Is it important to test more than one worm?*

5) **Where are worms most sensitive to touch?**

Using a swab, pupils can touch the worm along its body at two or three points e.g. the head, middle and tail. Record the outcome.

Teaching prompts: *How will you know if the worms reacts to your touch? Can you measure this? Is it important touch it with the same amount of pressure? Is it important to touch it for the same amount of time? Is it important to test more than one worm?*

6) **Which types of food do worms prefer?**

Place a selection of 4 different foods at different edges of the tray, place the worms in the middle and cover the tray with card. Wait for 5 minutes and record the outcome.

Teaching prompts: *How will you know if the worm prefers a certain type of food? Can you measure this? Is it important to put the same amount of food/type/consistency? Is it important to test more than one worm?*

7) **Do worms have a sense of smell?**

Using a swab, pupils dip the swab in liquids that have different smells (e.g. water, lemon juice, vinegar, mustard water) and hold it near to a worm. Note: the worms should **never** be directly touched with these liquids.

Teaching prompts: *How will you know if the worm reacts to a smell? Can you measure this? Is it important to hold the swab the same distance away? Is it important to present the smell the same amount of time? Is it important to test more than one worm?*

8) **Are worms sensitive to different sounds?** Place the worm at one end of the tray. Make a sound outside of the tray close to the worm. Record the outcome.

Teaching prompts: *What different sounds can you make? What can you use? How will you know if the worm is affected by the sound? Can you measure this? Is it important to test more than one worm? Is it important to make the sound for the same amount of time?*

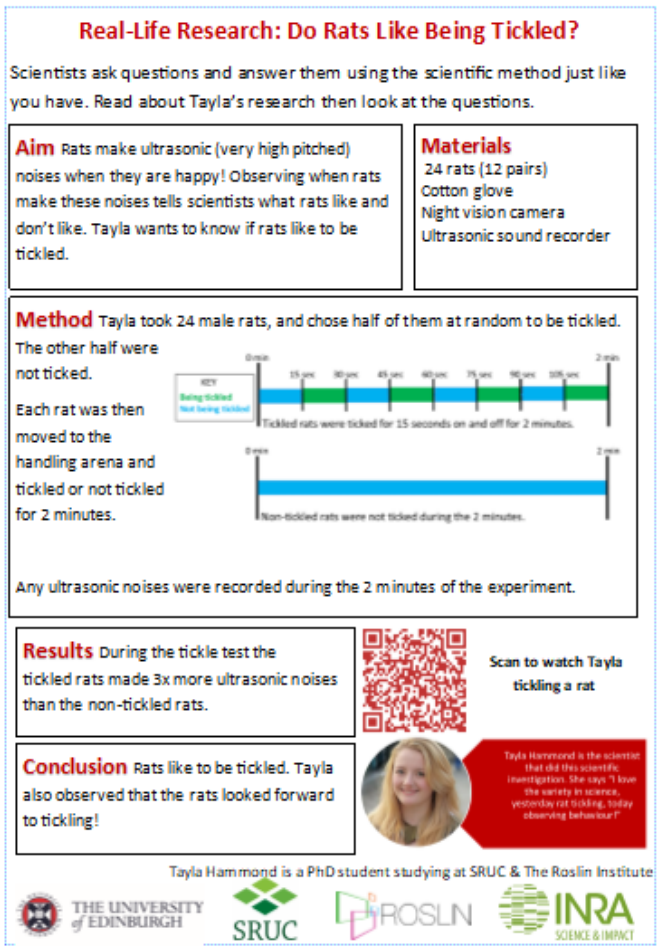
What are the links to numeracy and literacy?

Numeracy in science	Literacy in science
➢ Encourage your pupils to carry out quantitative analysis (measuring in units) o Measure the distance the worms move o Counting and/or scoring positive, negative or neutral reactions ▪ Positive reaction = moving towards the stimulus = +1 ▪ Negative reaction = moving away from the stimulus = -1 ▪ Neutral reaction = no reaction to the stimulus = 0 ➢ Calculating averages ➢ Creating tables and charts to represent results	➢ Encourage your pupil to carry out qualitative analysis (description in words of what they observe) ➢ Make a word wall with scientific vocabulary ➢ Ask pupils to create scientific posters (based on the sections of their investigation book) that can be displayed in the classroom ➢ Ask pupils to prepare an oral presentation for the class, school or for their families. You can record it and create a video montage ➢ Ask pupils to write a descriptive story about the earthworm in its natural habitat ➢ Ask pupils think and write about why it is important to understand animal behaviour/ensure animals have good welfare

How do my pupils investigations relate to real-life science?

We have prepared two examples of how the scientific method has been used at The Roslin Institute to determine the behaviour of two different types of animals. These can be downloaded from www.ebsoc.ed.ac.uk > Classroom Resources > Teacher Toolkit and can be found on the final pages of the pupil experiment booklet.

Real-Life Research: Do Rats Like Being Tickled?



Overview: Scientists ask questions and answer them using the scientific method just as you have. Pupils read about Tayla's research then look at the questions.

Answer key:

1) What activities do you think rats do that make them happy?
Play, eat, cuddle

2) Why do you think Tayla kept the rats in pairs?
Rats are social animals, so keeping them in pairs ensures that their life in the cage is as similar to their natural life as possible. It gives them the opportunity to play and socialise with their partner.

3) What part of the scientific method is missing? Can you write it?
Hypothesis - students' own answers.

4) How many rats were tickled?
12 rats were tickled (out of 24 total).

5) Why did Tayla only tickle some of the rats?
The 12 rats that were not tickled are the control for the experiment. Without these rats Tayla would not be able to tell if the rats made the ultrasonic noises because of tickling.

6) Why do you think it is important to understand positive emotions, like happiness, in animals?
Students' own answers

If you require any further information please email ebsoc@ed.ac.uk

To keep updated with all our new teaching resources and hands-on workshops sign up to our mailing list by visiting www.ebsoc.ed.ac.uk

Want to know more?

Here is a list of resources to further explore the topics covered in this toolkit:

- **Understanding Animal Research** is an organisation that explains the use of animals in research, they have free classroom resources to explore this topic further with your pupils: http://www.understandinganimalresearch.org.uk/
- If you want to know more about animal welfare and behaviour, there is an online course run by the University of Edinburgh called **Understanding Animal Behaviour and Welfare** https://www.coursera.org/learn/animal-welfare
- **OPAL Soil and Earthworm Survey**: Carry out a survey of earthworms using this resource https://www.opalexplorenature.org/soilsurvey
- The **Nuffield Foundation** has some more practical ideas such as observing locomotion https://www.nuffieldfoundation.org/practical-biology/observing-earthworm-locomotion

Share your science!

We encourage you to share what your class gets up to with this toolkit, you can tweet @EBSOClab #BehaviourToolkit to share your science beyond the classroom! Alternatively, send us an email ebsoc@ed.ac.uk along with some photos that we can share via our website and Twitter account.

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This resource has been developed by the Easter Bush Science Outreach Centre

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