Association for the Study of Animal Behaviour

A Key Stage Three Scheme of Work using animal behaviour to teach practical skills, data analysis, adaptation, habitats, learning, conditioning, natural selection, DNA profiling and field work.

This resource has been written by

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Lesson 1

An introduction to **animal behaviour** through the medium of hamster.

Behavioural adaptations of hamsters…

Resources required:

- Hamster or three…
  (Depending on group sizes and number of students)
- Cardboard boxes (loads)
- Thick card
- Scissors
- Glue/sellotape
- Powerpoint

Time	Activity	Notes/Resources
10 minutes	Show hamster PPT Questions: • What are these? (*hamsters!*) • Where do they live? (*Syrian desert*) • How do they survive there? Discussion of the last question should focus on the idea of **adaptations** to survive in a desert environment with lots of potential predators. This could include all kinds of physiological adaptations (e.g. cheek pouches/teeth/eyesight/camouflage) but try to elicit answers that describe **behavioural** adaptations (e.g. being nocturnal).	Hamster PPT Check allergies - are any students allergic to animal hair?
15 minutes	Sit students kneeling down in a closed circle. Two or three circles with a hamster each would be best and less stressful for the animals. Introduce a hamster to the circle. The students will be very excited but get them to focus on what the animal is *doing*. Key skills are observation and thinking. In particular, ask them to observe what the hamster does and think about how this behaviour helps them live successfully in the desert. Discuss ideas. Questions might include *why does it stick to the edges?*	The hamster will explore the perimeter, but rarely, if ever, venture into the middle – it will be very curious and try to climb up and out of circle – students should gently place hamster back on ground if this happens. Welfare of the hamsters is an obvious concern and this practical should only be carried out with responsible students.
20 minutes	Introduce idea of a maze to test ideas about hamster behaviour/intelligence. Possible questions: • Can hamsters learn where a food source is? • Do hamsters alternate turning patterns to optimise foraging success? • Others? Teams of 4 then choose a testable hypothesis and design an experiment and appropriate maze to do so. Emphasize the need for controls and repeats.	See questions and examples of types of maze at end of powerpoint.
15 minutes	Groups start to build their mazes in preparation for the next lesson…	The edges of the maze can be built with the cardboard boxes in the lab – the paths are built with card.

Lesson 2

Investigating hamster behaviour using mazes and hamsters.

Time	Activity	Notes/Resources
10 minutes	Student continue to build and refine mazes. Construct results tables.	Hamster PPT
30 minutes	Students let loose the hamsters in the mazes collect data and refine the maze	Welfare of the hamsters is an obvious concern and this practical should only be carried out with responsible students.
10 minutes	Students return hamsters to somewhere safe and have team debrief. They should clear away and discuss how are they going to process and present their data.	
10 minutes	Students share what they have discovered with the rest of the class. How could they refine their experiment? What further questions could they investigate	

Lesson 3

Hamsters are quite complicated animals and, as they found out, testing ideas about them is difficult. In this lesson, students use cardboard tubes, choobs, to test ideas about **maggot behavioural rules**.

Resources required:

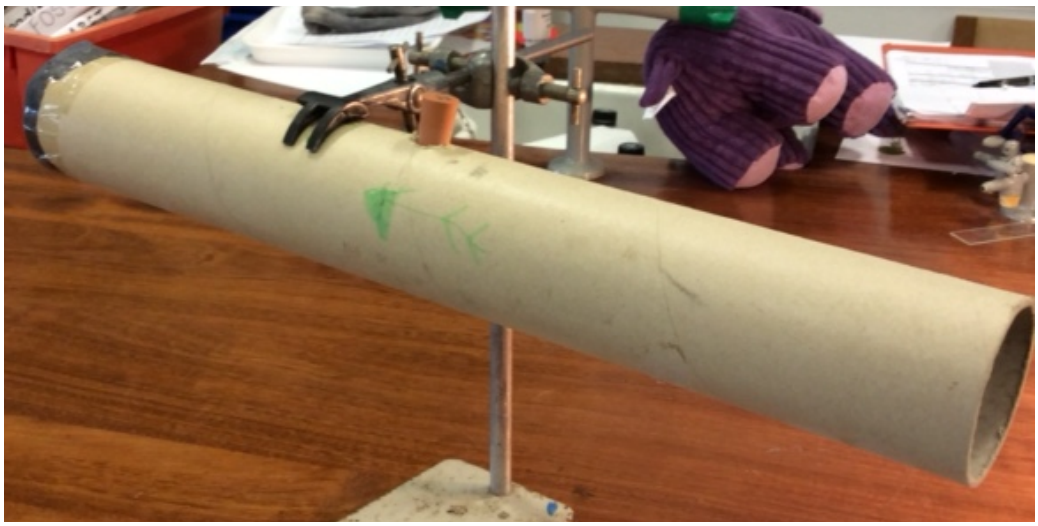
- Maggots
- Cardboard tubes
- Lamps LED or Filament

Lesson 3

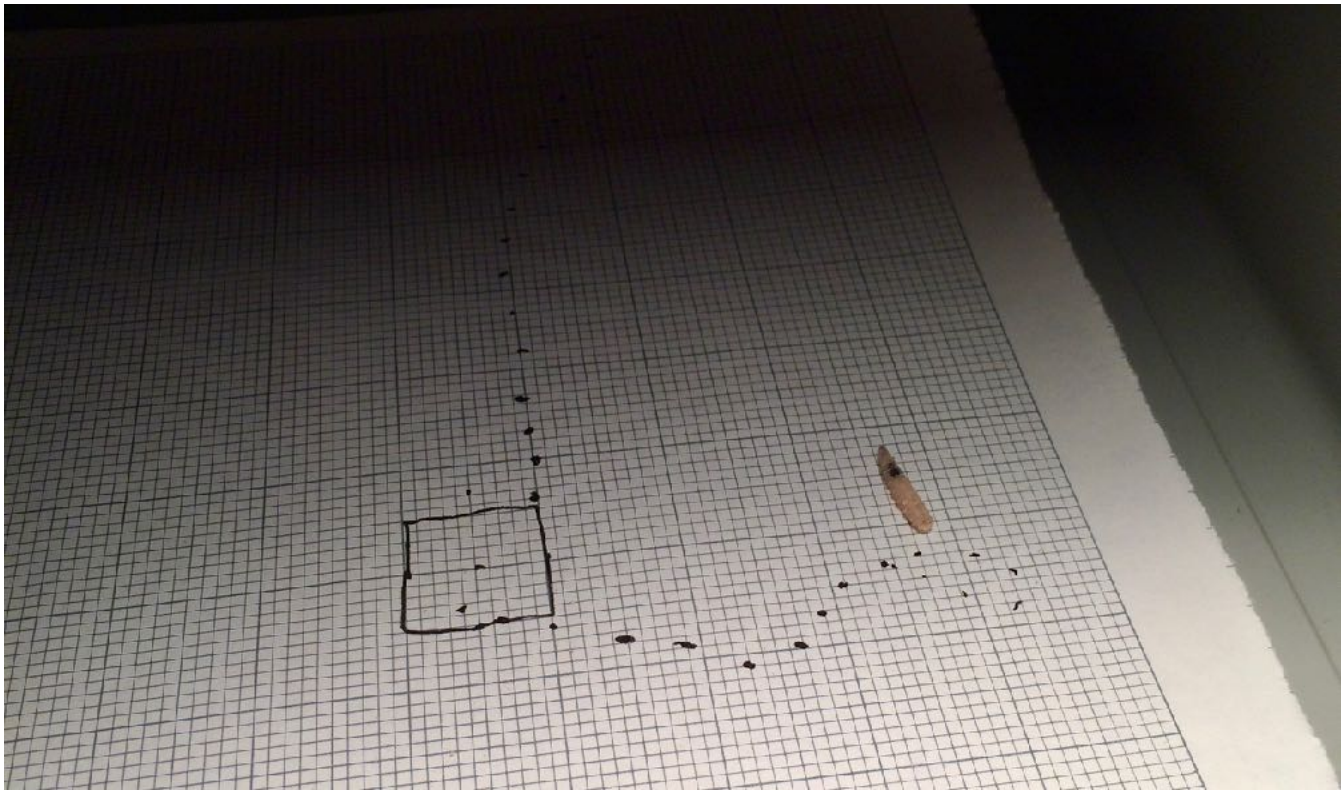
Maggots and choice choobs…

Time	Activity	Notes/Resources
15 minutes	Demo maggots Give the students time to recover from the ugh ewwww oh yuck responses. What do they have in common with hamsters? i.e. both animals. What do they know about maggots? What are they? PPT of blowfly lifecycle Emphasize point that maggots live in dark, warm, wet places. (also emphasize incredible-ness of lifecycle!)	Maggots Blowfly PPT
40 minutes	Maggot experiments **Maggot Choice Choobs** Students design and carry out an controlled experiment to test hypothesis that maggots move away from light. LED lamps will produce mostly light. Filament lamps, light and heat. They will need to collect data and present it in an appropriate graph. Challenge the students on alternative explanations for their results/control. E.g. maybe the maggot turns away from heat? Maybe the maggot always goes north? And see if they can modify their design to take these into account.	Maggots Choice choobs Lamps Material for making one end of tube dark

The *Choice Choob* is simply a long cardboard tube with a hole cut half way along, suitable for inserting maggots, and with a bung to eliminate light….



Time	Activity	Notes/Resources
	Maggot kinesis Don't give the students any background to this. Just tell the students to carry out the activity and think about (a) *what could they measure?* And (b)*how is this behaviour adaptive?* On 4 x A3 sheet (i.e. an A2 sheet), place maggot in middle and add drop of food colouring onto the maggot. Leave maggot to move for set period of time (1 to 2 minutes, depending on how frisky they are). The maggot will leave a food colouring trail. This should be repeated in light conditions and with a tray over the top (dark conditions). The students should figure out (**i.e. don't tell them**) that you could measure how far the maggot travels in the time (how?) and how many turns the maggot makes in the time (how?). They then think about how this difference is helpful for being a maggot. Again, results in table and graph.	A3 paper Food colouring (red and green) Pipettes String Rulers Stopclock
5 minutes	Quick tour of the groups – what did they find out? What do they think it means?	The odd maggot might travel towards the light - this is a sign that the maggot is ready to pupate.



Lesson 4

Cuckoos and their hosts. Students are introduced to the idea of evolutionary arms races, where the behavioural adaptation of one species can result in a new behavioural adaptation in another species. The context is cuckoos and the birds whose nests they parasitise.

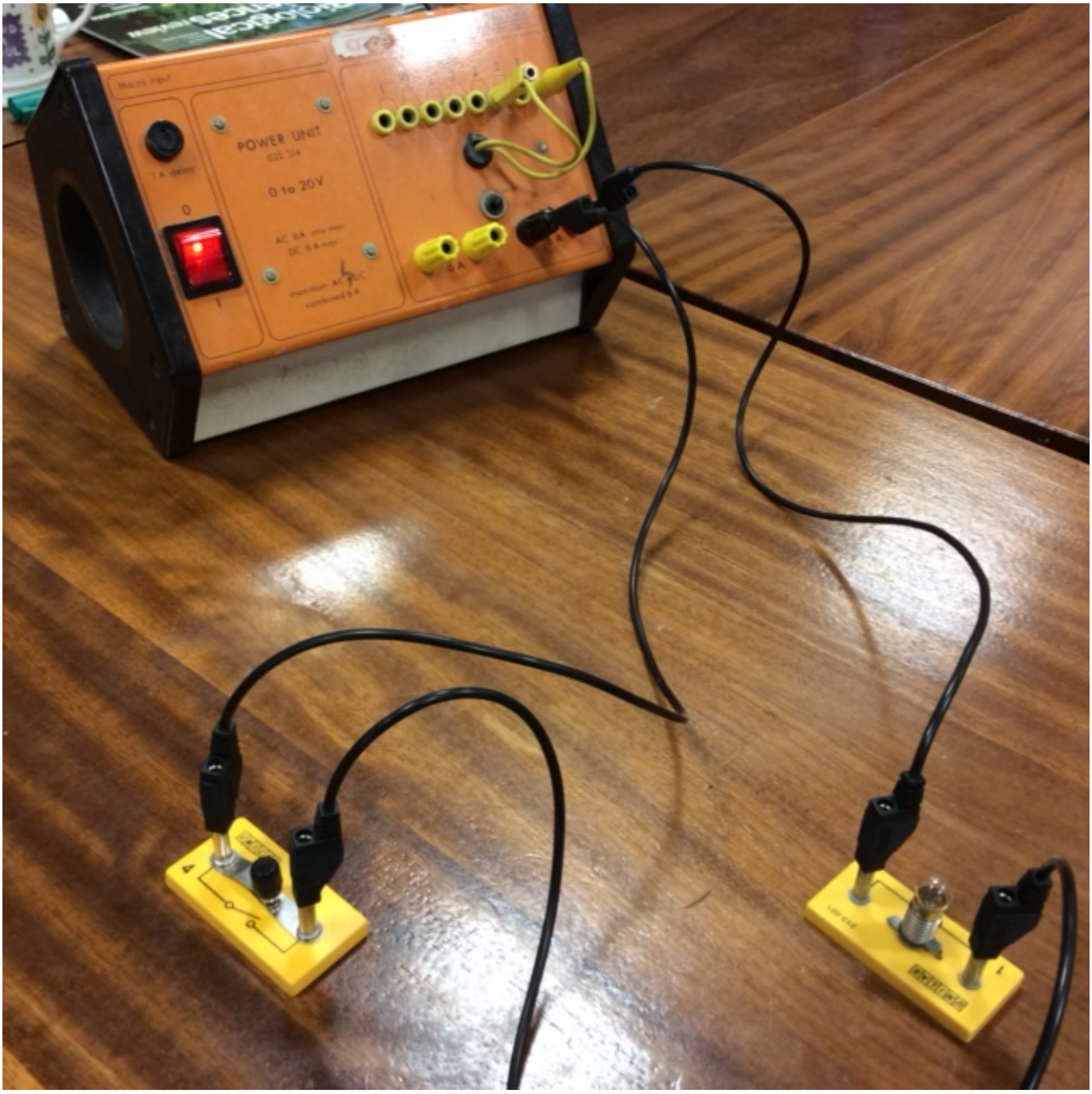
The lesson models the arms race through role play, as some students, as the host birds, work out appropriate responses to the cuckoo's behaviour. Other students, playing the cuckoos, then have to work out a new strategy in response to the host birds' new defence.

Resources required:

You can find a detailed description of this lesson here:
How do you like your eggs in the morning?
https://www.asab.org/educationsecondary/#cuckoo

Lesson 5

Skinner Box role play. Students discover the principles of operant conditioning through role play. Two students operate the reward/punishment mechanism of the Skinner box – the rest of the class take it in turns to be the experimental rats, being put into the Skinner box to see what happens when an intelligent animal explores its environment.



Resources required:

A classroom with movable desks and chairs. Two simple circuits that include both a bulb and a switch. Two boxes of Maltesers. Two meter rulers. A separate but adjoining classroom/corridor, An i-pad for filming the experiment is not essential, but is highly recommended!

Time	Activity	Notes/Resources
10 minutes	Reflect on lab experiments. Advantages of studying behaviour in lab – reiterate the idea of it being easier to control variables. Comment on problems of getting permission to work on rats. So instead, today, they're going to be the rats.	
15 minutes	Demonstrate Skinner box. Don't explain anything. Just say that they will be put in the Skinner box and their behaviour recorded. Send all students out except the 2 operators and explain what they'll be doing. For the first experiment, whenever a "rat" presses a button and lights a lamp, they get a malteser. Bring other students back one at a time. Put them in Skinner box. **For this first run, every student is doing experiment 1.** Observe/film behaviour for 15 seconds max – if they've done nothing after 15 seconds, take them out. If they learn to press the button for smarties, stop them after 3 smarties. Record time. Should be able to get through class in 10 minutes... Nb: most students will probably just stand in the box, terrified of getting something wrong, unsure what to do because they haven't been told. It's always interesting to see which ones start exploring and try pressing the buttons… "Rats" who have been in the box get to watch the other "rats" being tested. This is comedy gold as the ones who didn't get a reward become outraged at the ones who figure it out…	Skinner box buttons and lights Instructions for operators Tubes of smarties/box maltesers
15 minutes	Discussion. What's going on? Idea of curious rats exploring their surroundings. How is this different to maggot behaviour (idea that maggots behave automatically, but here they're learning a new behaviour). Idea that animals can learn a behaviour if it's reinforced with a reward. How could this be useful to an animal in the wild?	

Time	Activity	Notes/Resources
20 minutes	Skinner box variations For this bit, all the students can stay and watch because each learned behaviour is different. I'd start with the students who didn't get a reward on Experiment 1 – work through until Experiment 9, and then select at random (if there are still students to be tested). You could stop and discuss results after each test, or wait until end. Main difference is that the reward behaviours become much more complicated and that there are now punishment behaviours...	Skinner box buttons and lights Instructions for operators Tubes of smarties Long rulers
5 minutes	Questions for discussion Which is better for learning, reward or punishment? Can they think of any examples where they have learned to avoid anything through "punishment" (e.g. stinging nettles, wasps).	
10 minutes	If time... Depending on how it's going, a demo of Pavlovian conditioned reflexes is quite fun... Prime one student in advance to (gently) bonk another student on the head with a cardboard tube every time you rang a bell. Victim flinches at the sound of the bell after 3 or 4 goes… What's going on here? Play back film/report results	Cardboard tube Bell

Instructions for Skinner Box controllers

(Note - descriptions refer to the button on your side of the box)

Experiment 1 (this is for ALL the "hamsters" who will ALL do this experiment)
If animal presses button, give them a smartie.

Experiment 2
If animal presses button, give them a smartie.

Experiment 3
If animal presses button, do nothing.

Experiment 4
When the animal enters the Skinner box, start prodding them with a ruler until they press the button. Then stop.

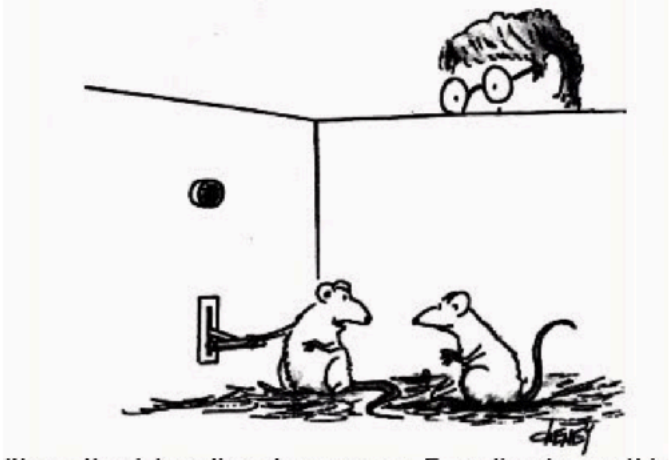
Experiment 5
Do nothing on this experiment.

Experiment 6
If animal presses button 3 times in a row, give them a smartie.

Experiment 7
Do nothing on this experiment.

Experiment 8
Do nothing on this experiment

Experiment 9
If animal presses buttons 5 times quickly, give them a smartie



Lesson 6

Barnacle feeding behaviour. Students observe barnacle filter feeding behaviour – by counting the rate of cirral beating at different temperatures. From this, they can construct a simple line graph that clearly shows a correlation between activity rate and temperature.

Resources required:

- Barnacle introductory ppt
- Small rocks with barnacles attached
- Sea water
- Fridge.

Time	Activity	Notes/Resources
15 minutes	Demo rock with barnacles: Does anyone know what this is? Where do they live What are the challenges of this life style? Does anyone know how they feed? Describe and explain "beating behaviour" (barnacle opens little trap door at top, waves some "fronds" out to catch food, and then brings them in and shuts door) you can use the Barnacle PPT here.	Discussion is focussing on adaptive behaviour of living on the tide line. Barnacle PPT
35 minutes	Tell students to carry out an investigation into the effect of temperature on the rate of "beating behaviour" Reassure them that "0" is a valid score! Note: Barnacles will show little or no beating behaviour at temperatures between 5-15'C, but should become increasingly active above this. Just let sea water come up to room temperature – no need to set up water baths. Record rate as beats per minute. In between recording, get students to find out the following: ▸ What is life like as a barnacle? Describe the little animal inside the hard shell ▸ What species of barnacle are they looking at? ▸ What is the barnacle life cycle?	Small rocks with barnacles Refrigerated seawater Glass dishes Thermometers Hand lenses Stopclocks Chrome books/ipads/ something to research with Barnacle ID sheet https://www.glaucus.org.uk/Barnacles.html
10 minutes	Get students to plot a graph of their results and describe it in as much detail as possible – if they've done it right, they should get a perfect Q10 curve – can they spot the pattern?	
Homework	Students could produce a poster of their findings, practical and research.	

Lesson 7

Who's your daddy? Students play the part of both baboons and scientists as they explore social hierarchy and stress in baboons. They learn about DNA profiles and how to interpret them, gain an insight into the nature of African field work, and find out how it feels to be part of a natural pecking order (but without the ability to speak!). Although designed as a KS4 lesson - it can be easily adapted for younger years.

Resources required:

Who's your daddy?
https://www.asab.org/educationsecondary/#baboon

Acknowledgements

The Association for the Study of Animal Behaviour (ASAB) would like to thank Paul Weeks for his endless enthusiasm for teaching animal behaviour and for sharing this scheme of work.

Thank you to Evie Bentley for her excellent proof reading and good idea skills.

ASAB would also like to thank all these fantastic photographers and scientists for the use of their brilliant photographs. Paul Weeks (lab photos), Charlotte Evans (maggot practical), Alecia Carter (baby baboon), Meg Lauber (hidden hamsters including front cover), Steve Snodgrass (maggoty squirrel), Susannah Anderson (feeding barnacles) and Don Schuetze (barnacles on a rock).

Blow fly PPT: Nick Goodrum (caterpillar), Angela Parker (feeding caterpillars), Peter von Bagh (peacock pupae), Robert Pittman (peacock butterfly).

Hamster PPT: Please contact education@asab.org if you should be credited for any of these images.

Barnacles PPT: comeonworkitout (beach), Oli (barnacles on rock), Susannah Anderson (close up images of barnacles), Marcus Ng (swimming crab with barnacles).

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