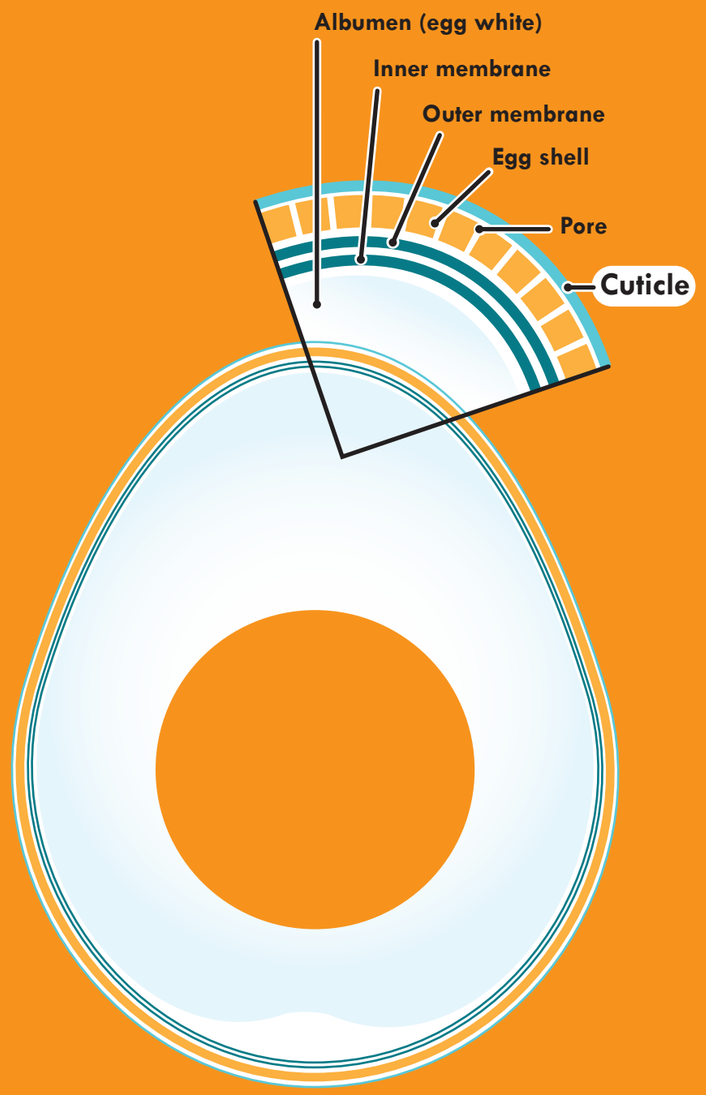


For more information visit
www.roslin.ed.ac.uk/CuteEgg

Other information

A good quality cuticle can protect eggs from invasion by bacteria such as *E. coli*, *Bacillus cereus*, *Staphylococcus aureus*, *Salmonella*, *Enterococcus faecalis, Clostridium perfringens* and *Yersinia enterocolitica*.

Selective breeding for cuticle quality provides a way of **protecting animals and people against bacteria without using antibiotics.** This is important because some of these bacteria, like *Staphylococcus aureus*, are becoming resistant to antibiotics.

To selectively breed for a characteristic like cuticle quality, you need to be able to measure it. In practice, **variation in cuticle quality can be very subtle.**

Scientists at the University of Edinburgh's Roslin Institute and School of Chemistry, and the University of Glasgow have **developed a way to measure cuticle quality that is sensitive enough** to pick up natural variation.

Using an instrument called a spectrophotometer, cuticle quality can be measured by detecting the amount of light reflected from the egg surface before and after cuticle staining.

The more the egg has stained, the less light it will reflect. Eggs that have a good cuticle will stain a lot and have a big decrease in the light reflected.

Being able to measure cuticle quality has allowed scientists to show that **selective breeding for cuticle quality will not affect the number of eggs that a chicken lays.**

BBSRC Science on the farm www.bbsrc.ac.uk/scienceonthefarm

ROSLIN

THE UNIVERSITY of EDINBURGH

LEAF LINKING ENVIRONMENT AND FARMING

University of Glasgow

Cute Egg Activities

Instruction booklet

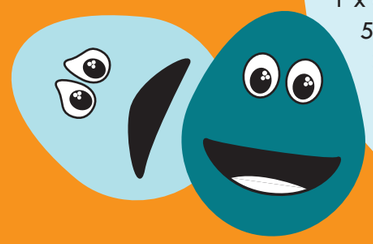
This booklet should give you all the information you need to run the Cute Egg activities at an Open Farm Sunday event. This includes setup and running instructions for two activities, suitable for all the family: **Cute Egg: Invasion Challenge** and **Cute Egg: Staining**

Background

Some bacteria are harmful to eggs, chickens and humans, and some bacteria are not. **Harmful bacteria,** like *E. coli*, **could get through** the very small holes (pores) in **the shell** that usually allow air inside for the growing chick. The bacteria either come from the hen during laying, or from the environment after the egg is laid. In extremely rare cases this could harm the growing chick or cause the egg to spoil.

Luckily, **eggs are naturally protected from these bacteria** by a layer of protein on the very outside of their shell. This layer is called the **cuticle** and is a bit like the cuticle on your fingernails. **Some hens are better at producing eggs with good cuticles than others.** Poor cuticles can be too thin, or patchy, with large gaps that allow the bacteria to pass through into the egg, or not even there at all. This is **determined by the chicken's genes.**

Egg producers and **farmers need to know that their hens are producing good cuticles** so their **eggs will always be safe.** Our work to measure cuticles and understand the link between a chicken's genes and its cuticle quality will **help to breed chickens with better cuticles.**



This kit contains:

1 x egg dipping tool
1 x staining container
1 x washing container
4 x plastic egg trays
5 x pairs safety glasses
10 x disposable lab coats
3 x concentrated egg dye
1 x concentrated cuticle removing solution
5 x "Giant Microbes" plush bacteria
3 x boxes disposable vinyl gloves
2 x A1 information posters
1 x egg stand template
100 x Cute Egg postcards

Cute Egg: Staining

You will need:
Egg dipping tool
4 Plastic egg trays
Staining container
Washing container
Disposable vinyl gloves
Concentrated egg dye
Disposable lab coats
Concentrated cuticle removing solution
Safety glasses
(all in kit)

Aim

Show the presence of the protective cuticle layer on the surface of eggshells using a non-toxic dye.

NOTE: The quality of this cuticle layer naturally varies between birds, giving different shades of dyed eggs, but the differences can be very subtle within a single batch of eggs.

We recommend that you enhance this by removing the cuticle from some of the eggs before you run the activity, so that visitors can clearly see the difference. Before dyeing, these eggs will look identical to the untreated eggs in the batch (with an intact cuticle), but when they are dipped in the dye they won't take up any of the colour.

Cuticle removal

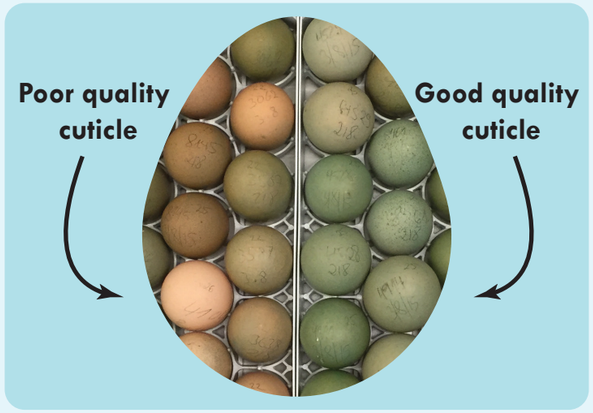
1. Dilute the concentrated cuticle removing solution up to the two litre mark with water in a suitable container (one of the plastic containers provided is fine if it is rinsed thoroughly before you run the egg staining activity).

2. Dip the eggs you want to de-cuticle (up to half of your total number of eggs) into this solution for 3 minutes using the egg dipping tool.

3. Remove the eggs using the egg dipping tool and dry them. These eggs will now look similar to the other eggs in the batch, but will have had their cuticle removed.

4. Put the 'normal' eggs into tray 1 and the 'decuticled' eggs into tray 2. They should look very similar and your visitors shouldn't know that one set have had their cuticle stripped off.

Why not...
put a message, pattern or smiley face on some of the eggs using the cuticle removing solution and a cotton bud?



Activity setup

1. Pour one container of the concentrated egg dye into the staining container and top up to the fill line with approximately two litres of water.

2. Fill the washing container up to the fill line with approximately three litres of water.

3. Set up trays of eggs with and without their cuticle removed and empty trays for the dyed eggs, and protective clothing, and set out the postcards for visitors to take away.

Egg staining activity

NOTE: Before starting the activity please ensure the person doing the staining is wearing disposable gloves, safety glasses and a disposable labcoat/apron. Although this dye is harmless it WILL stain the skin.

1. Take an egg from tray 1 (untreated, with cuticle) and place in the egg dipping tool.

2. Dip the egg into the staining container for 30 seconds.

3. Remove egg and place into the washing container and move up and down four times to wash off excess dye - place the egg into the empty egg tray.

4. Repeat for an egg from tray 2 (treated to remove cuticle).

5. The result should be a nicely blue/green coloured normal egg and an unstained decuticled egg.

Cute Egg: Invasion Challenge

You will need:
"Giant Microbes" (in kit)
To make 2 egg models:
Egg stand template (in kit)
A1 thick card or foamboard
Drawing pins, tape and glue
Thick wool, string or twine

Aim

Show how the variation in cuticle quality affects the vulnerability of eggs to invasion by bacteria like *E. coli*, *Staphylococcus aureus* and *Bacillus cereus*. Poor cuticle quality means bacteria could enter the egg more easily than with a good protective cuticle layer.

Activity setup

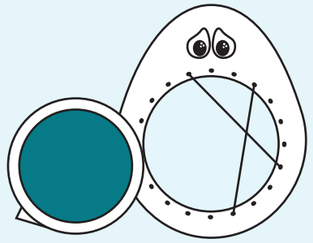
1. Using the template and instructions provided on it, cut out two egg shapes and sets of stands from thick cardboard or foamboard.

2. Either make small holes around each inner hole and thread the string across the hole in each egg, or use drawing pins pushed into the card or tape to secure the string, to create a network/mesh of string across the hole.

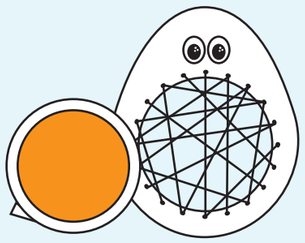
Feel free to...
use the eyes on the template to stick on the egg models to add a bit of character...

3. Make one egg with a mesh that has large gaps/holes – this represents a poor quality cuticle (use the dark spots on the template) – and the other with a mesh with small gaps/holes (use the light spots on the template) – this represents a good quality cuticle.

NOTE: Make sure you make the gaps large enough on the poor cuticle egg for the supplied soft-toy bacteria to pass through!



Poor quality cuticle egg model



Good quality cuticle egg model

The invasion challenge

1. Set up egg models on a sturdy surface, such as a low table. Place something solid like a small box behind the units, or tape them to the table, to ensure that they stay upright when the bacteria are thrown at them.

2. The poor quality cuticle model should be used before the good quality cuticle model, so have them arranged in that order.

3. Give the visitor the soft-toy bacteria (5 provided in kit) and challenge them to throw them through the first egg model – the poor cuticle. Since the cuticle has lots of gaps they should be able to get some through.

4. Collect up the bacteria and challenge the visitor to try the same thing with the good cuticle model – this time the tighter mesh should stop the bacteria from getting through, just like a real cuticle.

5. Use the poster to show exactly where the cuticle is found on the shell, emphasising that it is on the very outside and is what they are actually touching when they hold an egg.

Some people confuse the cuticle with the inner membrane that you see when you crack open an egg - these different parts are labelled on the poster.