

CHICK EMBRYOLOGY – LESSON 3

Time Needed

- Flexible depending on the age of the students and level of discussion: 10-60 minutes

Skill/Grade Level

- Can be adapted for K-12 students

Core Area

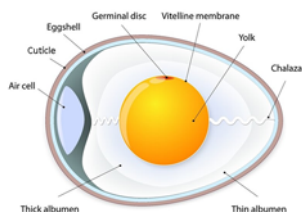
- Agriculture
- Animal production

Life Skills

- Participation in group discussion
- Sharing experiences and ideas

Educational Standards

- AA2: Participate in conversation, discussion and group presentations
- EL1: Acquire current and emerging industry-related information



Objectives/Outcomes

- Students will learn the parts of an egg and their importance in embryo development.

Introduction to Content

This lesson will teach youth to identify the parts of the egg. Different egg nutrients are in the various parts of an egg which also have different functional properties.

Curriculum

The materials required for this lesson are included. There is a separate PowerPoint on the parts of an egg.

Background Information

While eggs are an important, inexpensive and nutritious food item they are a means of reproduction in birds, including the chicken. There are different parts of an egg, and each is important to the development of the embryo.

Materials Needed

- Make sure that you have hand sanitizer and/or handwashing facilities enough for the number of students you will be working with.
- Store bought conventional brown and white eggs – an egg of each color for every student or group of students
- If possible, fertile eggs
- Small flashlights for candling the eggs in a dark room
- Large plate
- Saucer for each participant

Getting Ready

Make sure you have the required materials ahead of time.

Learn more at www.kentucky4h.org or contact your county extension office.



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Activity 1: Examining the eggs



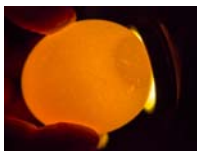
1. Gather the students in a group and have a carton of store-bought eggs for them to look at.
2. Explain that they were laid by chickens and that baby chickens come from fertile eggs once they are incubated.

Fertile eggs will only produce chicks if incubated. In a fertile egg, the embryo goes into a type of hibernation until the correct incubating conditions are provided. There is no development of the embryo unless the eggs are warmed. This is an important feature of bird eggs, since it allows the hen to produce many eggs before incubating the whole group and have them hatch at the same time.

3. Explain that the eggs were purchased from the grocery store and are infertile so will never be able to hatch out a chick.

You do not need a rooster for a hen to lay an egg. Commercial farms house only female chickens, no roosters allowed. So, all the eggs produced are infertile and can never produce a chicken, even if incubated.

4. Shine a light through the egg while in a darkened room.



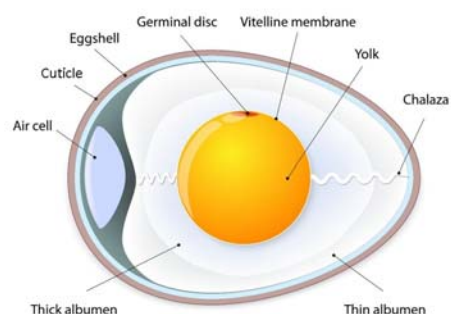
There is an air cell in the blunt end of every egg. It is this air cell that a developing chick embryo will use as a source of air to breathe once its lungs are developed and right before it hatches. Eggs bought in the store are infertile, so no chick will develop if these eggs are incubated, but they still have an air cell.

Although the air cell usually forms in the large end of the egg, it occasionally moves freely toward the uppermost point of the egg as the egg is rotated. This is referred to as a free or floating air cell. If the main air cell ruptures, resulting in one or more small separate air bubbles floating beneath the main air cell, it is known as a bubbly air cell.

As the egg ages, moisture and carbon dioxide leave through the pores of the shell, air enters to replace them, and the air cell becomes larger.

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Activity 2: Parts of the egg contents



1. Discuss the shell and the cuticle portions of the egg

The **shell** is the egg's outer covering and it accounts for about 9-12% of the egg's total weight, depending on the egg size. The shell is the egg's first line of defense against bacterial contamination. The shell is composed largely of calcium carbonate (about 94%) with lesser amounts of magnesium carbonate, calcium phosphate and other organic matter including protein.

Shell strength is greatly influenced by the minerals and vitamins in the hen's diet, particularly calcium, phosphorus, manganese, and vitamin D. If the diet is deficient in calcium, for example, the hen will produce a thin or soft-shelled egg, or possibly an egg with no shell at all. Occasionally an egg may be prematurely expelled from the shell gland due to injury or excitement. In this case, the shell has not had time to be completely formed.

Shell thickness is also related to egg size, which, in turn, is related to the hen's age. As the hen ages, egg size increases. The same amount of shell material which covers a small egg must be 'stretched' to cover a larger one. As a result, the shell is thinner.

Uses for eggshells vary from the thrifty (compost) to the creative (decorating).

There are 7-17 thousand tiny pores distributed over the shell surface. A greater number of them are in the large end. As the egg ages, these tiny holes permit moisture and carbon dioxide to move out and air to move in to form the **air cell**.

When an egg is first laid, it is coated in a mucus referred to as the **cuticle** or bloom. This invisible coating adds an extra layer of protection to the egg keeping the bacteria out and preventing the egg from drying out. The cuticle eventually dries up and falls off. It is also removed when eggs are washed.

2. Crack one of the eggs onto a saucer showing the correct way to safely break open an egg.



There is a specific way that eggs should be broken open for food safety. Hold the egg in your hand and use the back of a butter knife to break it open. Then use your fingers to separate the two halves of the eggshell and let the egg contents fall onto the saucer. Do not throw away the shell.

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Activity 2 (continued)

3. Examine the inside of the shell.



Look inside the shell to see if you can find the two shell membranes. The shell membranes are found just inside the shell. There are two – the inner and outer shell membranes. After the egg is laid it begins to cool. As it cools an air cell forms between these two layers. The air cell typically forms in the large end of the egg.

4. Discuss the parts of the egg content.

The most obvious portion of the egg contents is the yellow yolk. The yolk makes up 33% of the liquid weight (i.e., the part without the shell and shell membranes) of the egg.

Double-yolked eggs are often produced by young hens whose egg production cycles are not yet completely synchronized. They are also often produced by hens who are old enough to produce extra-large eggs. Genetics is also a factor. Occasionally a hen will produce double-yolked eggs throughout her egg-laying career. It is rare, but not usual, for a young hen to produce an egg with no yolk at all.

Yolk contains all the fat in the egg and a little less than half of the protein. Except for riboflavin and niacin, which are mainly found in the albumen, the yolk contains a higher proportion of the egg's vitamins than the albumen. All the egg's vitamins A, D, E and K are found in the yolk. Egg yolks are one of the few foods naturally containing vitamin D. The yolk also contains more phosphorus, manganese, iron, copper, and calcium than the albumen. It also contains all the zinc. The yolk of a large egg contains about 59 calories.

If fertilized, the yolk is the site of embryo formation. Look for the germinal disc. This is a small white dot that is a slight depression on the surface of the yolk. You may have to turn the yolk over to see it. The germinal disc is the entrance of the latebra, the channel leading to the center of the yolk. When the egg is fertilized, sperm enter by way of the germinal disc, travel to the center, and a chick embryo starts to form.

Surrounding the yolk is the vitelline membrane. The yolk is also known as the vitelline, thus the name for the membrane surrounding it. The vitelline membrane protects the yolk from breaking. The vitelline membrane is weakest at the germinal disc and tends to become more fragile as the egg ages. This is the reason that yolks tend to break in old eggs.

The albumen is the clear material. Albumen accounts for most of the egg's liquid weight, about 67%. It is also known as egg white, but it is more opalescent than truly white. The cloudy appearance of a fresh egg comes from carbon dioxide. As the egg ages, carbon dioxide escapes, so the albumen of older eggs is more transparent than that of fresher eggs. While albumen is known as egg white, it only becomes truly white when beaten or cooked.

Albumen contains more than half of the egg's protein, niacin, riboflavin, chlorine, magnesium, potassium, sodium and sulfur.

There are two main layers of albumen – thick and thin. The thick albumen is close to the yolk with the thin albumen surrounding it. Albumen tends to thin out as an egg ages because its protein changes in character. That is why fresh eggs sit up tall and firm in the frying pan while older eggs tend to spread out.

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Activity 2 (continued)

The ropey strands of egg white which anchor the yolk in place in the center of the thick albumen are known as **chalazae** (plural). They are neither imperfections nor the beginning of an embryo. They are also not ‘sperm sacs’ as some people believe.

The more prominent the chalazae, the fresher the egg. Chalazae do not interfere with the cooking or beating of the albumen and need not be removed, although some cooks like to strain them from stirred custard.

5. Have each student or group of students crack a white-shelled egg into individual saucers and explore and discuss their own egg.
6. Have the students break open a brown shelled egg and do a side by side comparison to see if they can see any differences.

There are no differences between brown and white shelled eggs except the shell color, which is determined by the breed of the chicken. Shell color is not related to quality, nutrients, flavor or cooking characteristics. Since brown egg layers are slightly larger birds and require more food, brown eggs are usually more expensive than white.

7. If available, have the students break open a fertile (or possibly fertile, since fertility is not guaranteed) and see if they can tell the difference between a fertile and infertile egg?

It is a common believe among some people that you can tell if an egg is fertile or not by candling it. This is not the case. Ask the students if they think the differences they noted could be seen when candling the eggs.

Apply

Share: What did you learn?

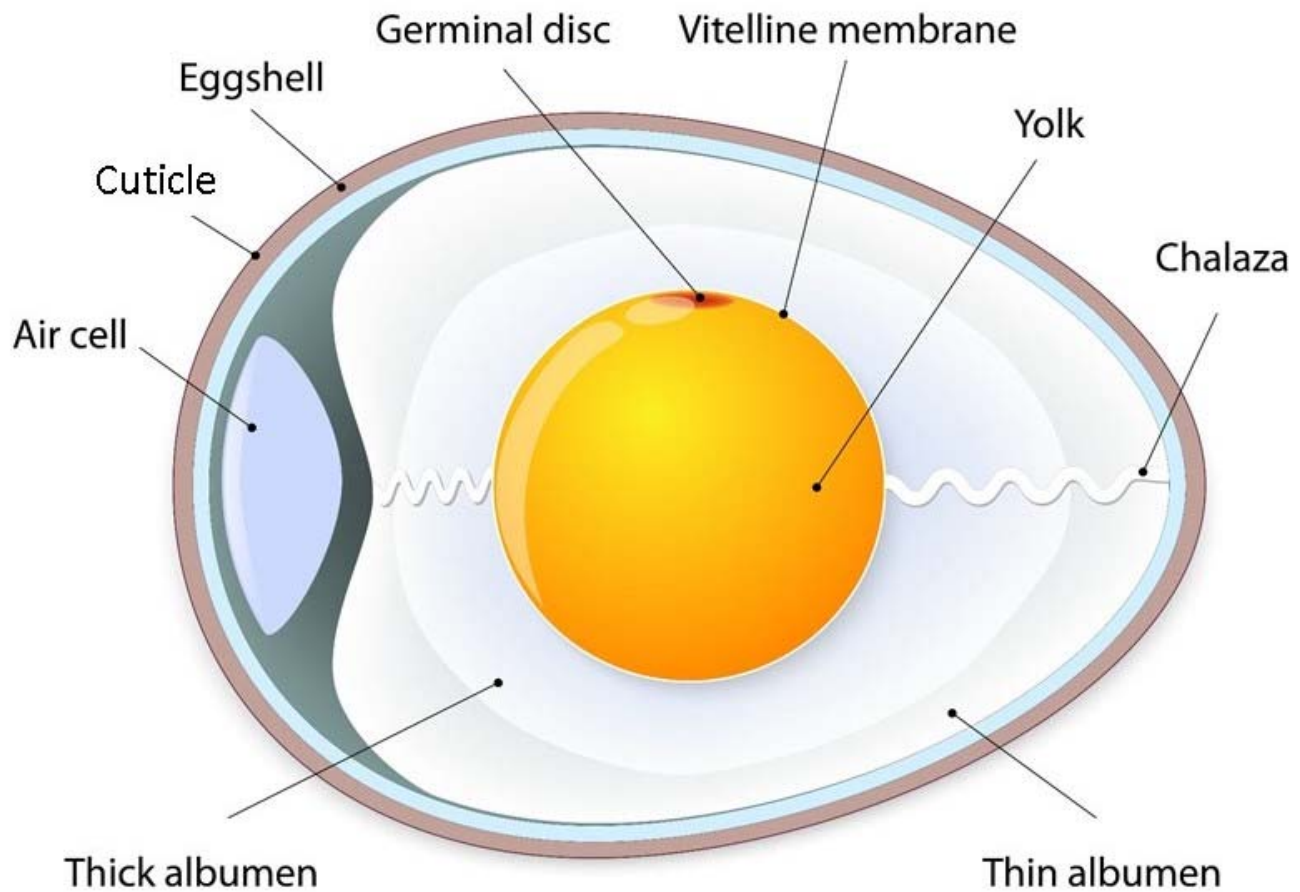
Process: What part of the activity taught you the most?

Generalize: What was the most important thing you learned? What role do you think the various parts of the egg play in the development of a chick embryo during incubation?

Authors

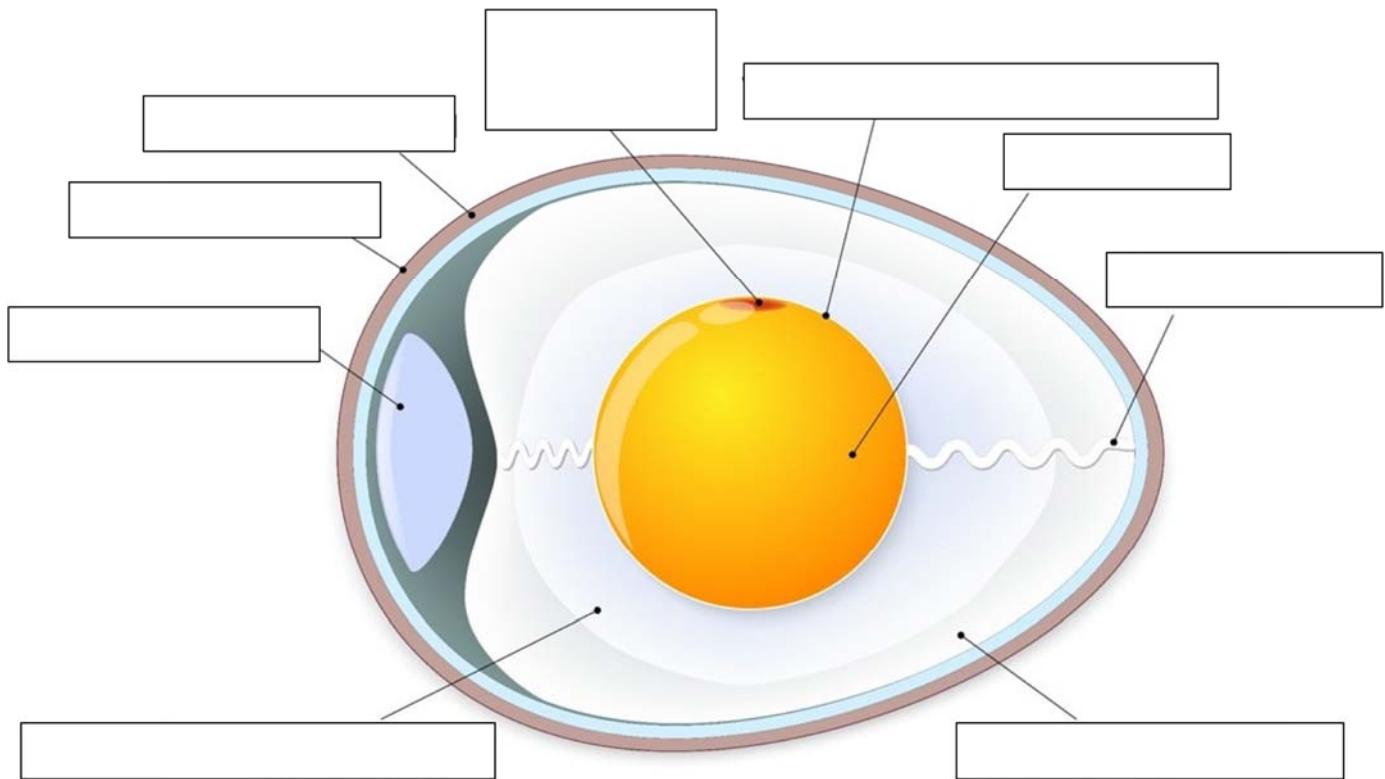
Dr. Jacquie Jacob, Poultry Extension Project Manager, Department of Animal and Food Sciences, University of Kentucky

PARTS OF AN EGG



PARTS OF AN EGG

NAME: _____



POSSIBLE ANSWERS:

Air cell
Chalaza
Cuticle
Eggshell
Germinal disc
Thick albumen
Thin albumen
Vitelline membrane
Yolk

PARTS OF AN EGG

NAME: _____

