

PARTS OF AN EGG

Introduction

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. Yolk also contains readily available lutein. The yolk of a large egg contains about 59 calories.

Albumen contains more than half of the egg's protein, niacin, riboflavin, chlorine, magnesium, potassium, sodium and sulfur. Egg substitutes are mainly made up of albumen. By leaving the yolk out, consumers are losing the fat-soluble vitamins A, D, E and K, as well as the lutein. Some minerals are also missing.

Activity 1: Examining the eggs

Materials needed:

- Carton of store bought white shelled eggs
- Small flashlights and a darkened room



1. Gather the students in a group and have a carton of eggs for them to look at. Make sure all the eggs are large end up.
2. Explain that they were laid by chickens and that baby chickens come from fertile eggs once they are incubated. Eggs are the chicken's method of reproduction. The egg must contain all the nutrients the developing embryo needs to grow into a chick. This is why eggs are so nutritious.

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 as in an incubator or under a broody hen. 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.



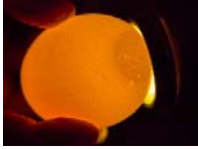
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You do not need a rooster for a hen to lay an egg. Commercial farms house only female chickens, no roosters allowed. So, all the eggs produced are infertile and can never produce a chicken, even if incubated.

4. Let the students touch, hold and observe the eggs and describe the shell, shape and smell.

When an egg is formed, there is a narrow, pointy end and a more rounded, blunt end.

5. 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 these, and the air cell becomes larger.

Commercially, the person candling the eggs uses the size of the air cell as the basis for determining the grade of the egg. In Grade AA eggs, the air cell may not exceed 1/8-inch in depth. The air cell of a Grade A egg may not exceed 3/16-inch in depth. For Grade B eggs, there is no limit on air cell size.

6. Discuss why it is important to store eggs large end up.

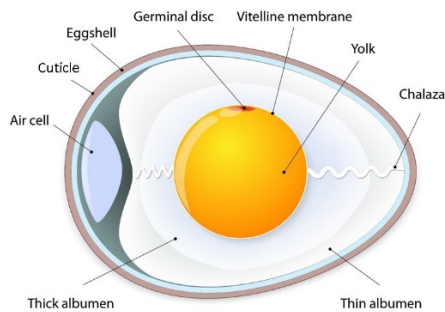
As an egg ages, air enters through the egg shell pores and moisture escapes. As a result, the air cell expands and gets larger. When an egg is stored pointy end up, the air cell will be on the bottom of the egg. The expanding air cell will slowly rise into the egg. This brings it closer to the yolk where it can dry out. This speeds up the 'aging' process of the egg. Keeping the yolk completely enclosed within the white protects the yolk from drying out. When the egg is stored blunt end up, more of the egg white surrounds the yolk preventing it from drying out and keeping it fresh longer.



Activity 2: Parts of an egg

Materials needed:

- Brown and white eggs
- Saucer for each participant
- Large plate
- Eggs for each participant
- Butter knives
- Optional: Eggs from pasture-raised hens



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 called the cuticle which seals the pores.

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 composting to 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**.



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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. Wash your hands after breaking open the egg.

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.

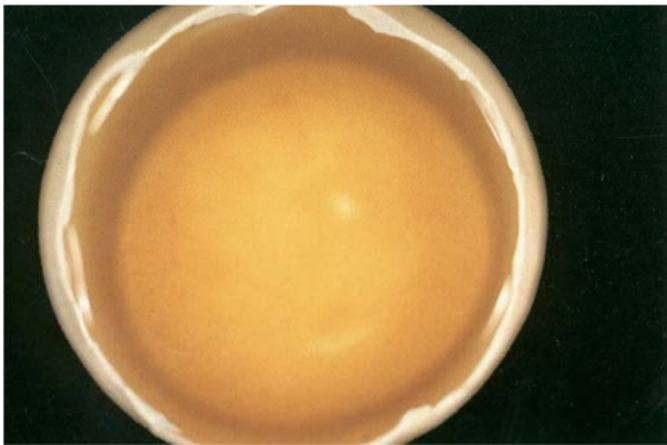
The most obvious portion of the egg contents is the yellow **yolk**. The yolk makes up 33% of the liquid weight (i.e., the part without the shell and shell membranes) of the egg.

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 unusual, for a young hen to produce an egg with no yolk at all.

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.

The photographs below show the difference between an infertile and fertile. Look at the white dot on the yolk. In the infertile egg, the dot is very small. In the fertile egg, the dot is much larger with a clear spot in the middle.





INFERTILE EGG



FERTILE EGG

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.

There are four layers of albumen – outer thin, outer thick, inner thin, inner thick (chalazae). The inner thin is closest to the yolk and hard to see. The outer thick albumen is close to the yolk with the outer 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.

The ropey strands of egg white which anchor the yolk in place in the center of the thick albumen are known as chalazae (plural). This is the inner thick albumen. The chalazae 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. The chalazae are very heat stable, so they will be the last to firm up in the pan when heated. Also, the chalazae are the layer of albumen that wraps up the yolk like a piece of taffy with one going clockwise and one going counter-clockwise, to hold the yolk in the center of the egg to keep it from moving from side to side and up and down. Remember, the egg is for reproduction so in the fertile egg the developing embryo



would remain in the middle of the egg and not get stuck on the inner shell membrane.

5. Have each youth crack an egg into individual saucers and explore and discuss their own egg.
6. Break open store bought conventional brown and white shelled eggs side by side and ask 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, nutrient content, flavor or cooking characteristics. Since brown egg layers are slightly larger birds and require more food, brown eggs are usually more expensive than white.

You can see differences if you compare conventionally-produced and pasture-raised eggs. The main difference will be the color of the yolk. Hens with access to pasture will have darker yolks.



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