

## EGG: STRUCTURE

### The Structure of a typical Ovum

Ovum is the female gamete. It stores food required for the entire process of development in the form of yolk. It has three important functions: The egg is a biological structure intended by nature for reproduction. It protects and provides a complete diet for the developing embryo and serves as the principal source of food for the first few days of the embryo's life. The egg is the organic vessel containing the zygote in which an embryo develops until it can survive on its own, at which point the animal hatches. An egg results from fertilization of an egg cell.

1. It supplies a haploid set of chromosomes to the future embryo.
2. It contributes almost all cytoplasm to the zygote.
3. It supplies food to the developing embryo.

Most arthropods, vertebrates (excluding live-bearing mammals), and mollusks lay eggs, although some, such as scorpions, do not.

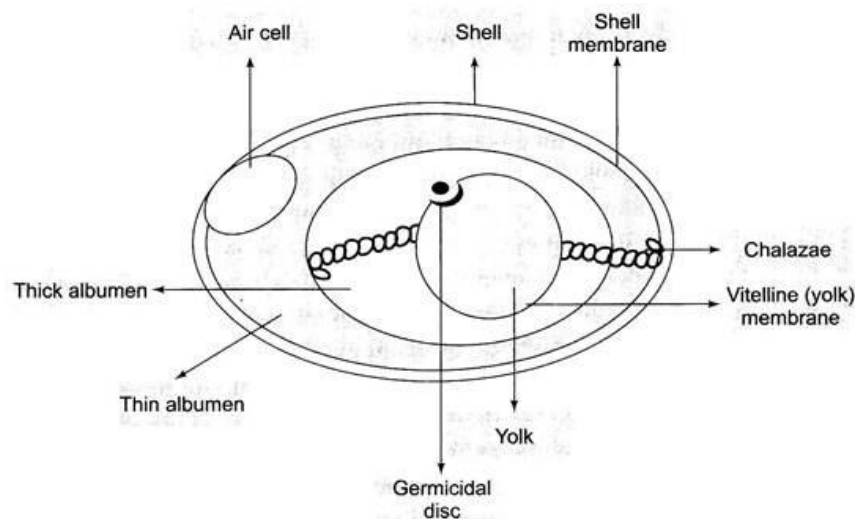
**Shape and Size** Typically, the eggs are spherical or ovoid in shape. But in a few animals like insects, the eggs are elongated and cylindrical in nature. Eggs are generally larger than the sperms and average somatic cells. The size of a mature egg depends on the amount of yolk present in it. The smallest known egg is that of mouse (0.07mm); the birds possess larger eggs. Ostrich lays the largest egg having a diameter of about 85 mm. The egg is covered externally by a plasma membrane or plasmalemma. Within the plasma membrane is the granular cytoplasm.

Reptile eggs, bird eggs, and monotreme eggs are laid out of water and are surrounded by a protective shell, either flexible or inflexible. Eggs laid on land or in nests are usually kept within a warm and favorable temperature range while the embryo grows. When the embryo is adequately developed it hatches, i.e., breaks out of the egg's shell.

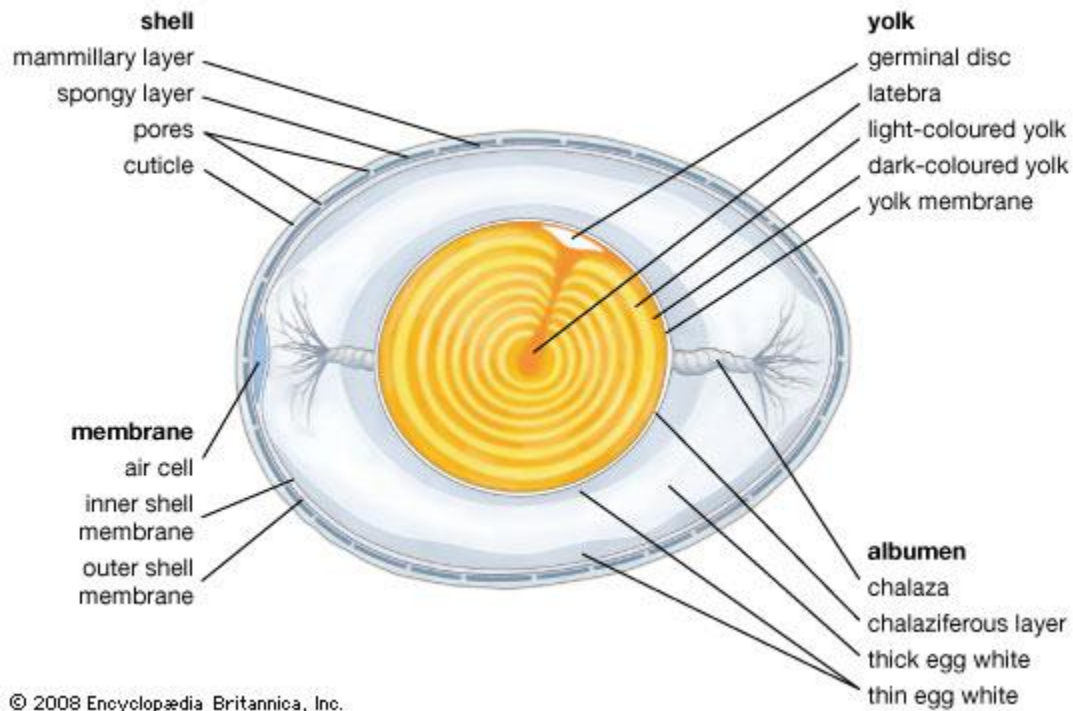
An egg basically consists of three parts:

1. a shell
2. an egg white
3. an egg yolk

Ex.: An egg from a hen consists of approximately 2/3 egg white and 1/3 egg yolk.



Structure of an egg



The yolk is well-centered in the albumen and is surrounded by the vitelline membrane, which is colorless. The germinal disc, where fertilization takes place, is attached to the yolk. On opposite sides of the yolk are two, twisted, whitish cord-like objects known as chalazae. Their function is to support the yolk in the center of the albumen. Chalazae may vary in size and density, but do not affect either cooking performance or nutritional value.

A large portion of the albumen is thick. Surrounding the albumen are two shell membranes and the shell itself. The shell contains several thousand pores that permit the egg to "breathe."

### **The eggshell**

The shell is built of 8-10,000 pores, which ensures that oxygen can penetrate and CO<sub>2</sub> and other gases can escape. The shell represents about 10 % of the weight of the egg and consists mainly of calcium carbonate and calcium phosphate. The shell thickness and thus the strength depends on egg size, breed, the age of the hen, and feed composition.

Only the outer layer of the shell is coloured. The colour of the shell can be white or brown – depending on the breed. A white hen lays white eggs and brown hens lay brown eggs. There are also white hens that lay brown eggs but this breed is currently not being used for production in Denmark.

### **The egg white**

The egg white represents approx. 60 % of the weight of the egg and consists of 88 % water and 12 % dry matter, primarily protein. The white is divided into three parts: an inner and an outer liquid layer, and in between those a liquid layer with a thicker consistency. The white prevents external bacteria from penetrating the yolk.

The pale yellow-green colour of the white is due to the presence of riboflavin (vitamin B2). In completely fresh eggs there are lots of small air bubbles, which can give the egg white a dull milky appearance. This is because of carbon dioxide that has not yet leaked out through the shell. The older the egg, the more transparent the egg white.

## The egg yolk

The yolk has a much lower water content than the egg white, just under 50 %. The yolk represents about 28 % of the weight of the egg and consists of approx. 2/3 fat and 1/3 protein. The fat content consists primarily of triglycerides, cholesterol, and the phospholipid lecithin. The amount of fat and cholesterol and the composition of the fat is influenced by the diet of the hen. The yolk is held in place by two screw-shaped egg white strands – the chalazae.

## Shell membranes

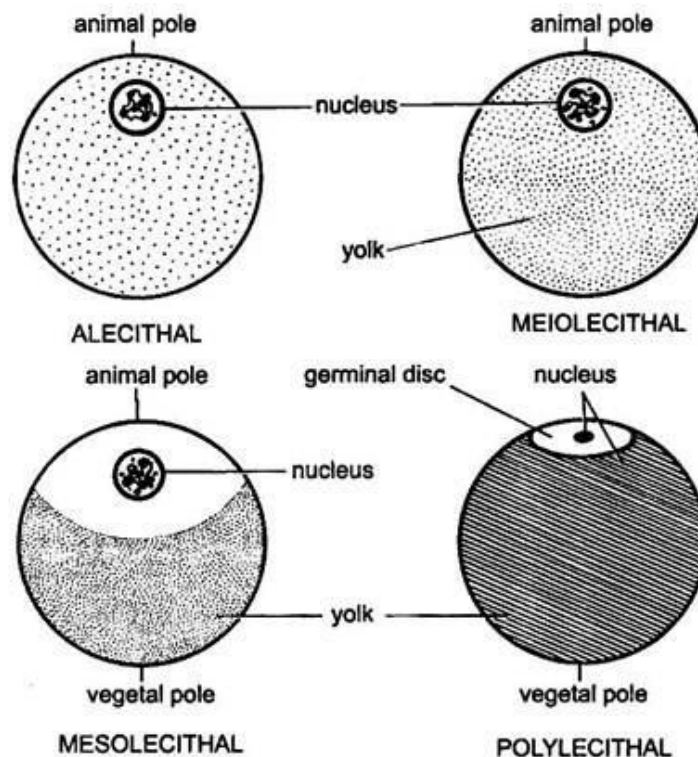
Under the shell there is an outer and an inner shell membrane. The outer membrane, which is immediately inside the shell, is the most resistant. Besides serving a packaging role, the shell and the shell membranes also have a biological function; namely to regulate evaporation and air circulation, but also to prevent penetration of microorganisms. A colourless wax membrane called the cuticle surrounds the outer shell. It is highly alkaline and therefore acts bacteriostatic.

## Air cell

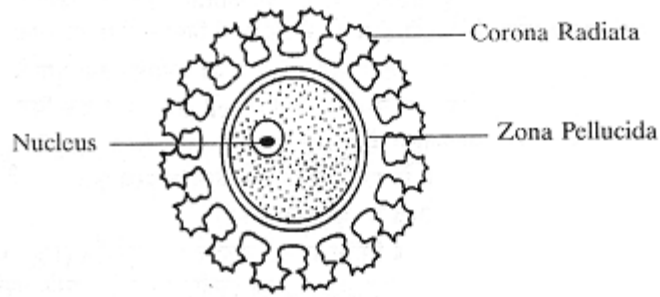
When the egg leaves the hen, it has a temperature of 39 °C. When it is cooled, there is a contraction of the contents and air can penetrate through the shell. In the heavy end of the egg, the outer and the inner shell membrane are split and the air cell is formed here. The older an egg is, the larger the air cell, as water continuously evaporates from the egg during storage.

## Bacterial retardant properties

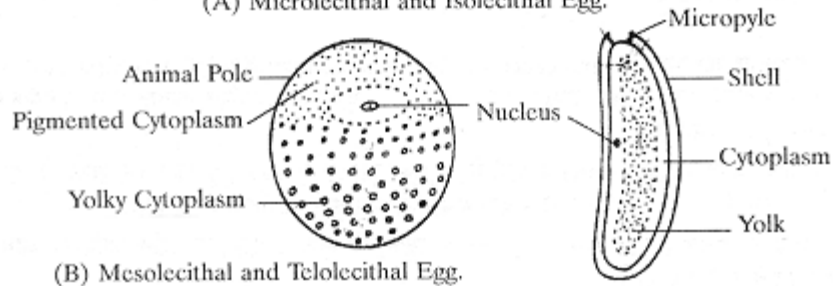
The egg white protects the yolk, be it among other reasons because of the enzyme lysozyme, which splits the beta-(1,4)-glycoside bond in the cell wall of gram-positive bacteria, wherein the bacterial cell is destroyed. The protein ovotransferrin is also bacteriostatic, in that the binding of iron to ovotransferrin limits the possibilities of certain bacteria's growth.



Types of chordate ova: 1- and 2- Isolecithal; 3- and 4- Telolecithal

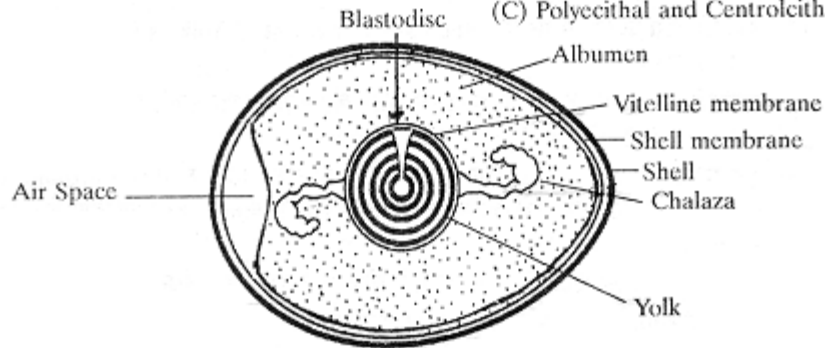


(A) Microlecithal and Isolecithal Egg.



(B) Mesolecithal and Telolecithal Egg.

(C) Polycithal and Centrolcithal Egg.



(D) Macrolecithal and Telolecithal Egg.