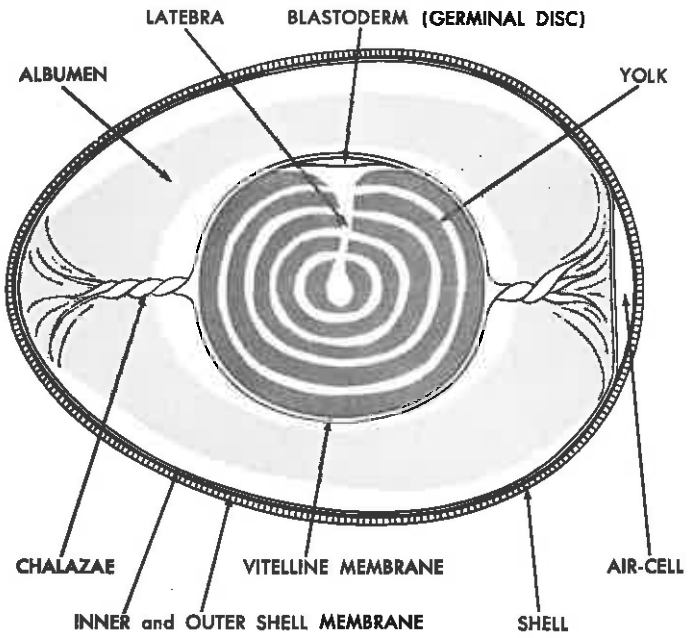
4-H LEADERS' SERIES
TEACHING UNIT L-8-15a



WHAT IS AN EGG?

E. A. Schano

As we know it, the egg is the single most nutritious food known to man. It is used every day in a multitude of ways in the preparation of the most common of the most fanciful meals.

But, scientifically-speaking, the egg is a single cell laid down by the female; when fertilized by the single cell or nucleus of the male sperm, it remains a single cell but then has its full complement of chromosomes and genes. This single cell rapidly divides into two cells, then four, eight, sixteen, thirty-two, sixty-four and so on until the faint outline of a developing embryo and a network of blood vessels that surround the yolk and other nutrients soon can be seen.

What is normally called an egg is a much more complex structure designed to nourish and protect a growing embryo. A vigorous healthy chick can be hatched from each fertile egg that has had nothing added to it except a warm, moist environment. Although human nutritional requirements are not the same as the chick's, they are similar in so many respects that the egg is a convenient, economical source of many of the essential proteins, minerals, and vitamins necessary to our good health.

Looking at the egg from the outside, we first see the shell which is a hard protective covering composed primarily of calcium-carbonate. The shell is very porous; the pores at the large end of the egg are larger and more numerous than those at the small end. Because the shell is porous it permits the transfer of gases. Atmospheric gases including oxygen are taken in, and carbon dioxide and moisture are given off through the pores.

Immediately beneath the shell are two membranes called the outer and inner shell membranes. These membranes protect the contents of the egg from bacterial invasion and prevent the too rapid evaporation of the liquid in the egg.

Because the body temperature of a hen is approximately 107° F., eggs are this temperature at the time they are laid. The temperature of the atmosphere normally is much lower than 107° F., and the egg cools to the temperature of its surroundings. As cooling takes place, the contents of the egg contract more than the shell of the egg. This creates a vacuum, and air is drawn through the larger more porous end of the shell. As a result the air cell is formed at the large end of the egg. The air cell serves as a tiny shock absorber during early embryonic development, and at the 20th day of incubation the chick pokes its beak into the air cell, which by this time has enlarged greatly, and draws its first breaths of air from this space.

The shell membranes surround and contain the white or albumen of the egg. The albumen is principally water that provides the liquid medium in which the embryo develops, but also contains large amounts of protein necessary for proper development.

In a fresh egg you can see two white cords that are attached to the yolk and to the inner shell membrane at the ends of the egg. These two cords, called chalazae, are made of twisted strands of mucin fibers which are a special form of protein. The chalazae hold the yolk in the center of the egg.

NEW YORK STATE COLLEGE OF AGRICULTURE, A STATUTORY COLLEGE
OF THE STATE UNIVERSITY, AT CORNELL UNIVERSITY

The yolk contains large amounts of fat and is also a reservoir of vitamins and minerals that are essential for normal growth. The fat in the yolk combines with oxygen that is taken in through the pores of the shell and together they provide tremendous amounts of energy. The by-products of this combination are water, which is used by the embryo to replace the water lost by evaporation, and carbon dioxide. The carbon dioxide combines with water to make a weak acid that dissolves the shell. The calcium portion of the dissolved shell passes through the shell membranes and is used by the embryo to make its bony structure or skeleton. The removal of calcium to make the bony skeleton weakens the shell and ultimately assists the chick embryo in making its exit from the shell.

The egg is truly a world of its own — a wonderful, versatile, nutritious food for humans and a miraculous means of reproduction for the chicken.

Activities

Break an egg into a dish. Referring to the cross-sectional drawing of the egg, have the club members identify the following parts: air cell, inner shell membrane, chalazae cords, albumen or white of the egg, yolk, germinal disc (blastoderm).

Incubate some fertile eggs for one, two, three, four, and five days. Break the incubated eggs into a dish. Using 4-H Teaching Unit, L-8-2d, *From the Egg to the Chick,* have the Club members make pencil drawings of the changes in the blastoderm. Also identify, in the various stages of incubation, the organs of the developing embryo.

Ask the Club members to list the parts that will be discarded by the embryo when it hatches (amnion, allantois, shell).

Ask the Club members to describe the function of the amnion, allantois and shell.

Have the members list some of the organs that appear in the early stages of development and are not discarded (heart, eyes, beak, wings, legs).

Ask members to tell how long it takes to incubate a chicken egg.

Ask members to describe the position of the embryo as it prepares to hatch.

Ask the members to write a few sentences describing the things that impressed them most about this lesson.

Single copies free to residents of New York State; additional copies 10 cents each.

Cooperative Extension, New York State College of Agriculture at Cornell University and the U.S. Department of Agriculture cooperating. In furtherance of Acts of Congress May 8, June 30, 1914. Edward H. Smith, Director of Cooperative Extension, Ithaca, New York.

Reprinted January 1970 PS 20M