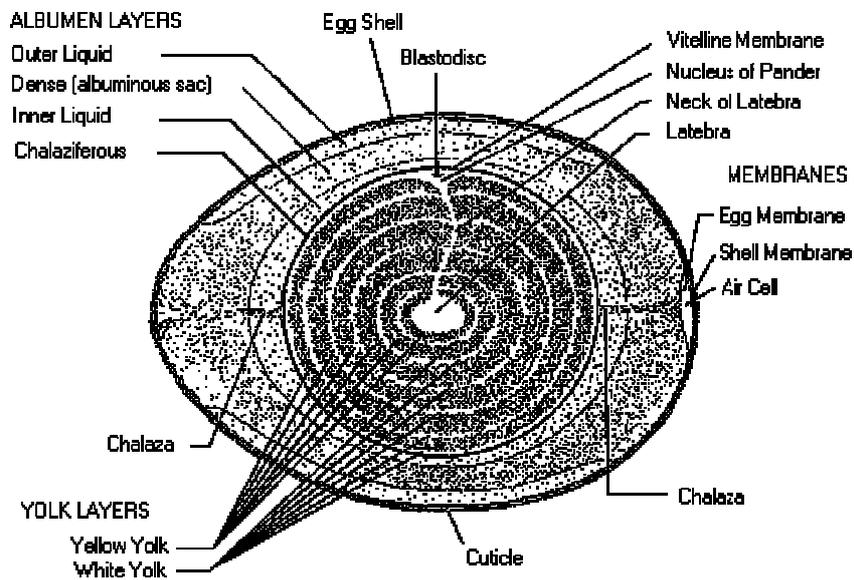


FORMATION AND PARTS OF THE EGG

The avian egg, in all its complexity, is still a mystery. A highly complex reproductive cell, it is essentially a tiny centre of life. Initial development of the embryo takes place in the blastoderm. The albumen surrounds the yolk and protects this potential life. It is an elastic, shock-absorbing semi-solid with a high water content. Together, the yolk and albumen are prepared to sustain life - the life of a growing embryo - for three weeks, in the case of the chicken. This entire mass is surrounded by two membranes and an external covering called the shell. The shell provides for an exchange of gases and a mechanical means of conserving the food and water supply within.

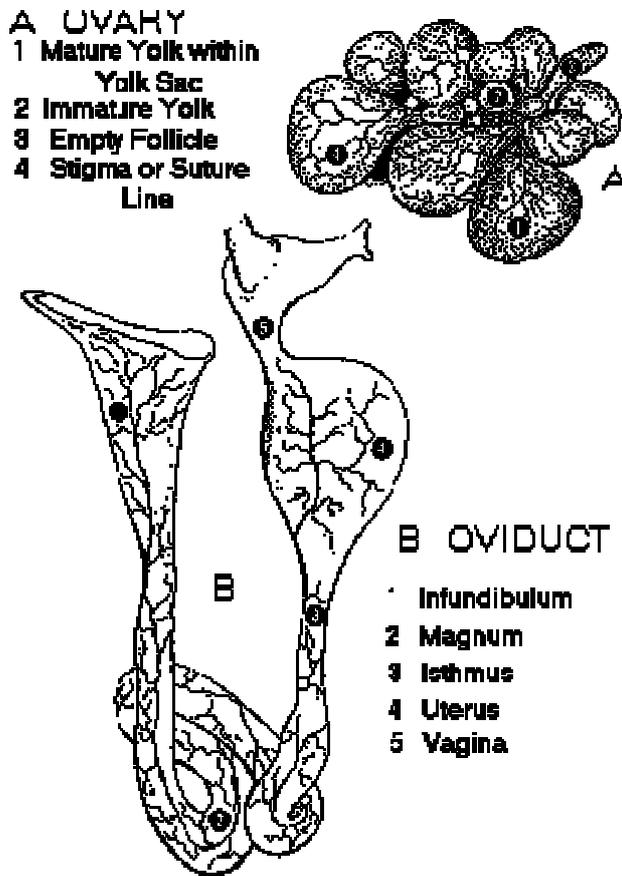


**STRUCTURE OF THE HEN'S EGG
SHOWN BY A SECTION THROUGH THE LONG AXIS**

A hen can produce an egg without mating. Such an egg, while edible, is not fertile and will not hatch. If a rooster mates with and fertilizes the hen, the male reproductive cell (sperm) unites with the female reproductive cell (ovum) to form a single cell that can develop into an embryo. This egg is fertile and can hatch. When an egg is opened and placed in a dish, you can see a light round spot on top of the yolk. This is the germinal disc, true ova, or female egg. At the time of lay, it is hard to tell whether or not it is fertile.

The egg is formed in the mature hen by a reproductive system composed of an ovary and oviduct. Most females have two functional ovaries, but chickens and most other birds have only one ovary and one oviduct. In early stages of embryonic development, each female chick has two ovaries; only the left one develops into a functional organ. In some birds, such as hawks, the right ovary and oviduct usually develop. A mature ovary

looks like a cluster of grapes. It may contain up to 4,000 small ova which can develop into yolks. Each yolk is attached to the ovary by a thin membrane sac or follicle having a fine network of blood vessels.



The oviduct is a large, coiled tube located in the left side of the abdominal cavity. In this oviduct, all parts of the egg, except the yolk, are formed. It is divided into five distinct regions: (1) infundibulum or funnel, (2) magnum, (3) isthmus, (4) uterus or shell gland, and (5) vagina. Each male chicken has two reproductive organs called testes, located within the body about midway of the back. The testes produce sperm cells which are complementary to the egg cells of the hen. Each sperm cell has a long whip-like tail which propels it forward. The sperm are conveyed to the cloaca through the vas deferens, a tube between the testes and cloaca. After mating, the sperm travel through the hen's oviduct and concentrate in storage sites of the

infundibulum.

The yolk is formed in the follicular sac by the deposition of continuous layers of yolk material. Ninety-nine percent of the yolk material is formed within the 7-9 days before the laying of the egg. The germinal disc of a developing yolk contains the single ovum cell which, after fertilization, develops into the chick. The germinal disc remains on the surface of the yolk throughout yolk formation.

When the yolk matures, the follicular sac ruptures or splits along a line with few, if any, blood vessels. This line is called "stigma." If any blood vessels cross the stigma, a small drop of blood may be deposited on the yolk as it is released from the follicle. This causes most blood spots in eggs. After the yolk is released from the follicle, it is kept intact by the vitelline membrane surrounding it. The release of the yolk from the ovary is called "ovulation."

After its release from the follicle, the yolk falls into the hen's abdominal cavity. The infundibulum of the oviduct quickly engulfs the yolk with its thin, funnel-like lips. If, for some reason, the infundibulum is unable to pick up the yolk from the body cavity,

the body will reabsorb the yolk. A hen that consistently fails to pick up the yolks from the body cavity is called an internal layer.

After the yolk is engulfed by the infundibulum, fertilization of the ovum follows almost immediately. Sperm cells from the male are stored in glands or nests located in the infundibulum, and are released when the yolk passes by. A sperm cell must penetrate the thin vitelline membrane and reach the female cell to complete fertilization. The vitelline membrane thickens as the rest of the egg is formed.

The yolk quickly enters the magnum section of the oviduct where the dense portion of the albumen is added. The albumen serves as a shock-absorbing substance and feeds the developing embryo. The shape of the egg is largely determined in this section.

The magnum is divided from the isthmus by a narrow, translucent ring without glands. The isthmus is smaller in diameter than the magnum. It is here the two shell membranes form. The shell membranes loosely contain the yolk and dense white until the rest of the albumen is added in the uterus.

The shell is added in the uterus or shell gland portion of the oviduct. The shell is composed mainly of calcium carbonate. It takes about 20 hours for the egg shell to form. If the hen lays brown eggs, the brown pigments are added to the shell in the last hours of shell formation.

The chalazae, two cord-like structures which keep the yolk centred in the egg, first appear in the uterus. The chalazae also function as an axis around which the yolk can rotate and keep the germinal disc uppermost at all times.

In the last portion of the oviduct, the vagina, a thin coating called "bloom" is applied to the shell to keep harmful bacteria or dust from entering the egg shell pores. The egg passes through the oviduct small end first, but is laid large end first. In the vagina, the egg is turned horizontally just before laying. If the hen is disturbed on the nest, the egg may be prematurely laid small end first. Oviposition is the act of pushing the egg from the oviduct.

When an egg is laid, it fills the shell. As it cools, the inner portion of the egg contracts and forms an air cell between the two shell membranes. A high quality egg has a tiny air cell, indicating the egg was collected soon after being laid and was stored properly. The air cell is usually located in the large end of the egg where the shell is most porous and air can enter easily. The chick punctures and breathes through his air cell just before hatching.