

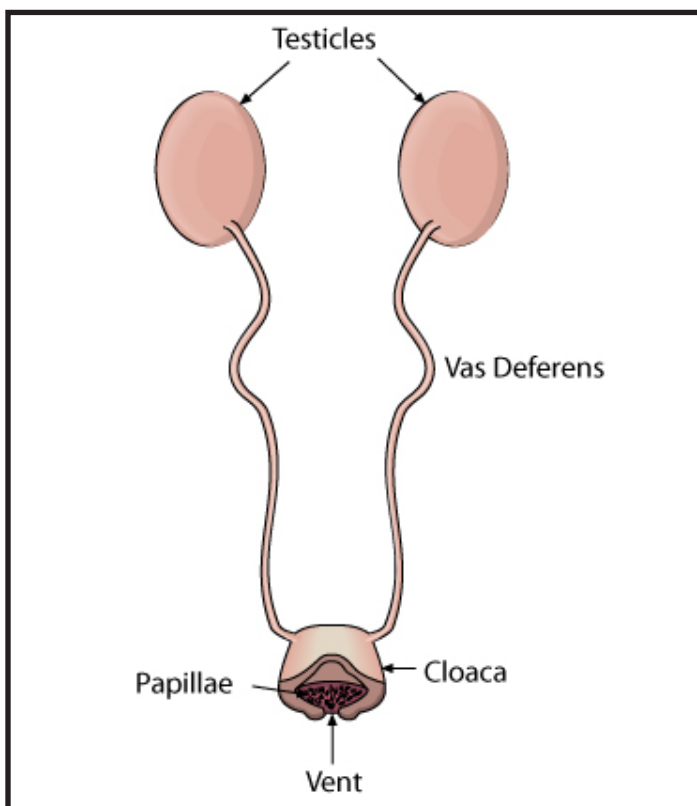
## Lesson 4: Reproduction

The male and female reproductive systems in poultry are very different from other livestock. The most obvious difference is that the egg is fertilized in the hen, surrounded by a hard shell, and expelled from the body. In other livestock, eggs are fertilized and grow within the female until birth.

### Male Reproductive Tract

The male reproductive system of poultry is completely contained within the body cavity. Figure 4.1 is a diagram of the male reproductive tract. The testicles are located along the backbone within the abdominal cavity. There are two testicles and they are made up of ducts that produce and secrete sperm. The testicles are connected to the vas deferens, which is a tube that transfers semen to the cloaca. The cloaca is the common area where the reproductive and digestive systems meet. The male cloaca joins the female cloaca in the mating process. Attached to the wall of the cloaca is the papillae. The papillae transport the sperm to the female reproductive tract during mating. The

Figure 4.1 - Male Reproductive System



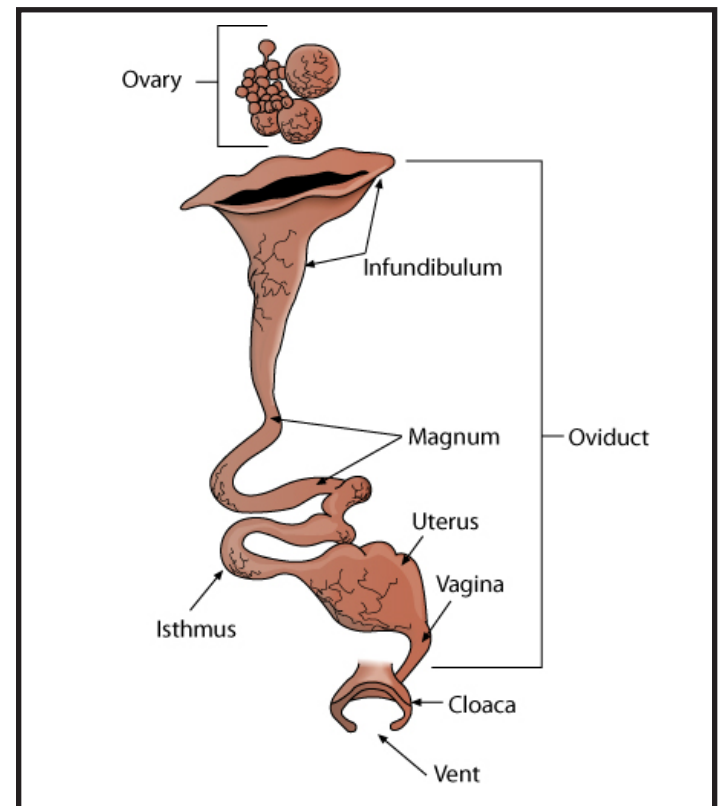
vent is the opening of the cloaca and releases the reproductive and digestive products.

### Female Reproductive Tract and Egg Development

The female reproductive tract of poultry is made up of the ovary and the oviduct. Figure 4.2 is a diagram of the female reproductive tract. The ovary produces the ovum, or “yolk,” which is the female reproductive cell. Poultry have two ovaries, but only the left one is functional. It is located in the body cavity near the backbone. The female chick has several thousand ova (plural of ovum) at the time of hatching. These may develop into full-sized yolk as the hen matures.

At maturity the ova are released from the ovary to enter the oviduct. The oviduct is a long tube made up of different sections where the remaining membranes are added to form the rest of the egg. The oviduct consists of the infundibulum, magnum, isthmus, uterus, and vagina. The

Figure 4.2 - Female Reproductive System



## Introduction to Poultry Production

The infundibulum is the funnel-shaped upper yolk from the ovary. The yolk spends about 15 minutes in the infundibulum. If live sperm are present, this is the area where the yolk becomes fertilized.

The yolk then moves into the magnum, which is where the albumen is secreted and forms various layers of egg white. The yolk remains in the magnum about three hours.

Next, the egg travels to the isthmus, which adds two shell membranes. The inner and outer shell membranes form to represent the final shape of the egg. At some point, the shell membranes separate and an air cell is formed, usually in the large end of the egg. The membranes act as a barrier to protect from outside organisms and prevent evaporation of the egg contents. The egg remains in the isthmus about an hour and fifteen minutes.

Once the shell membranes have formed, the egg is passed to the uterus. The uterus, also known as the shell gland, adds a thin, white shell. The developing egg remains in the uterus for about 20 hours while water is added through the shell membranes to the albumen, or egg white. Meanwhile, tiny particles of calcium carbonate are laid onto the shell membranes forming the hard outer shell.

Finally, the egg is passed into the vagina, which serves only as a passageway, where it remains for a brief period before passing through the cloaca. The egg is held briefly in the cloaca as it rotates so the large end is expelled first. The egg will then pass through the vent and out of the body.

### Parts of an Egg

The newly laid egg consists of four primary parts: the shell, membrane, albumen, and yolk (Figure 4.3).

The shell consists of three layers. The first shell is an inner mammillary layer consisting of sponge-like, calcium crystals. The next shell layer is made up of hard calcium crystals. This layer is more compact yet has thousands of microscopic pores that allow moisture and air to enter and exit the egg. Finally, the shell is

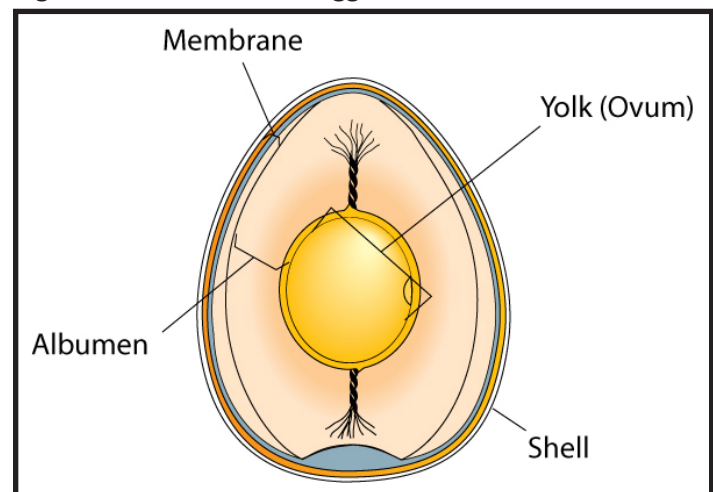
covered by the cuticle, which is a protective layer that helps prevent microorganisms from entering the egg.

Two paper-like membranes made of protein fibers exist inside the shell. The inner membrane holds the contents of the egg tightly together and the outer membrane is connected to the shell. The membranes act as a barrier to outside contaminants and reduce evaporation of the egg contents. The air cell forms at the large end of the shell where the two membranes separate.

The albumen (egg white) consists of four different layers: the outer thin, firm, inner thin, and chalaziferous. The yolk is surrounded by the chalaziferous layer. This layer extends into the chalazae, which are two twisted cords extending from opposite ends of the yolk. The chalazae helps to keep the yolk in place. The chalaziferous layer is surrounded by the liquid inner thin layer, then the more firm dense white, then the outer thin layers.

The yolk, or ovum, contains a germ spot, which is the female reproductive cell. The rest of the yolk is made up of layers that are a record of daily growth. The layers get their orange-yellow color from a substance called carotene, which is found in feed. Lighter colored layers reflect growth while the hen is not eating during the night. Darker colored layers indicate daylight hours when the hen is eating and has higher levels of carotene within her system. The yolk is surrounded by a membrane that helps maintain its spherical shape.

Figure 4.3 - Parts of an Egg



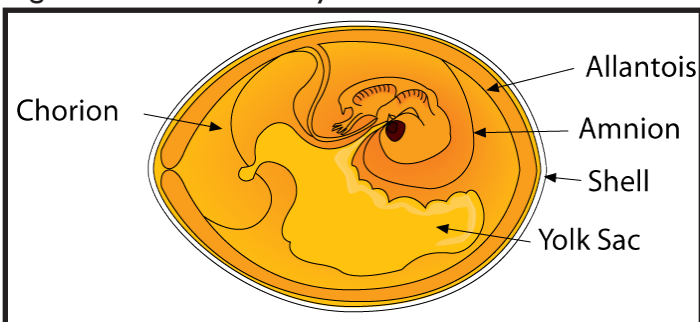
## Embryo Development

Embryonic development in chicks is an extremely rapid process. The entire embryonic development of a chick from fertilization to hatch is approximately 21 days. The embryo of a fertile egg starts the cell-division process as the egg passes through the warm oviduct of the hen that lays it. The embryo is alive.

Within three hours after fertilization the blastoderm, or fertilized egg, has already divided into two cells. After more cell division the blastoderm is divided into two different layers: the ectoderm and the entoderm. The ectoderm will form the skin, feathers, beak, claws, nervous system, lens and retina of the eyes, lining of the mouth, and lining of the vent. The entoderm will become the lining of the digestive tract, respiratory tract, and other secondary organs. A third layer develops, called the mesoderm, and develops into the bones, muscles, blood, reproductive organs, and excretory system.

Once the egg has lost connection with the mother's body, the embryo continues to support itself with membranes that will help to utilize food material. These membranes are the allantois, amnion, yolk sac, and chorion. Each of these membranes serves a specific purpose for the developing embryo. Figure 4.4 is a diagram of these membranes in an embryo at approximately 10 days.

Figure 4.4 - Chick Embryo



The allantois serves as the circulatory system. It absorbs oxygen through the pores in the shell and oxygenates the blood and removes carbon dioxide. The allantois also removes wastes from the kidneys, aids in digestion of albumen, and absorbs calcium from the eggshell.

The amnion is filled with amniotic fluid and serves to protect the embryo during development. The yolk sac surrounds the yolk and provides nourishment for the embryo to grow. The yolk sac is then drawn into the body cavity just before hatching and serves as temporary nutrition for the newly hatched chick.

The chorion fuses with the inner shell membrane and forms a protective layer around the allantois while it completes its metabolic functions.

## Reproductive Differences of Poultry From Other Livestock

A primary difference in the reproductive process of poultry from that of other livestock is that it occurs more rapidly. For example, the length of time from fertilization to birth for cattle is 281 days; swine is 114 days. The average incubation period for chickens is 21 days and 28 days for turkeys.

Another significant difference is a large portion of the embryonic growth and development of poultry takes place outside the mother's body. The hen prepares the egg but it is expelled from the body in about 24 hours. After the egg is laid, the hen serves only as an incubator until the chick hatches. In other livestock, the entire reproductive process takes place inside the mother.

Poultry differs from other livestock in the parts of the reproductive system. A major difference in the male reproductive system is that the testes of the poultry are located within the body cavity along the backbone. The testes of other mammals are located in the scrotum, which hangs from the body. In the female reproductive system of poultry, only one of the two ovaries is functional, whereas both ovaries are functional in other mammals.

## Summary

Reproduction of poultry is different from other livestock in many ways. Male reproductive parts are all located within the body cavity and consist of two testicles, the vas deferens, papillae, and vent. The

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female reproductive system includes the ovary and the oviduct. The ovary produces the ova, or yolk. The oviduct, comprised of the infundibulum, magnum, isthmus, uterus, and vagina, develops the membranes that make up the rest of the egg.

The main parts of an egg are the yolk, albumen, shell, and membranes. These components work together to form the fully developed egg. An ovary that becomes fertilized develops into a chick. Embryonic development begins from the time of fertilization and terminates after 21 days when the chick hatches from the egg. The embryo is supported by the yolk sac, amnion, allantois, and chorion.

The major differences in the reproductive process of poultry from other livestock is the length of time the ovum develops into a mature egg and the development of the egg outside of the mother's body.

### **Credits**

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