Digestion

The digestive system of the fowl is simple but very efficient (Fig 9.1). Food is picked up by the beak and selected on the basis of feel and appearance rather than taste. There is little or no evidence that chickens or other poultry can smell or taste.

The food, which is swallowed whole, passes quickly through the esophagus to the crop which acts mainly as a storage organ (Fig 9.1). In this organ the food is softened and acidified by lactic acid produced by bacterial fermentation. The food passes from the crop to the proventriculus by means of a short connecting tub where the food is acted upon by enzymes, particularly pepsin, and further acidified by hydrochloric acid. The proventriculus is the organ which most closely resembles the mammalian stomach. The gizzard is just beyond the proventriculus: it is a strong muscular organ which crushed the food by rhythmic contractions into a pulp. This process is assisted by the presence of insoluble grit. This hard grit is particularly valuable when whole grains are fed to birds but is not necessary when mash feeds are used. The food then passes into the duodenal loop which is the first part of the small intestine. This loop surrounds the pancreas which secretes pancreatic juices into the duodenum. Slightly lower down the intestine, the liver is joined to the small intestine by two ducts one of which comes from the gall bladder, which stores bile salts. The lining of the duodenum and the small intestine is convoluted into finger-like projections (the villi). These increase the surface area of the gut and thereby aid absorption of food. is moved through the small intestine by regular peristaltic contractions. It is in this region of the region of the gut that most

of the digestion and absorption of food takes place. At the junction of the small and large intestine are two blind sacs known as cecae. Their main function is to digest fiber and absorb water. The large intestine is also responsible for the absorption of water. From the large intestine the feces pass to the cloaca where they are evacuated.

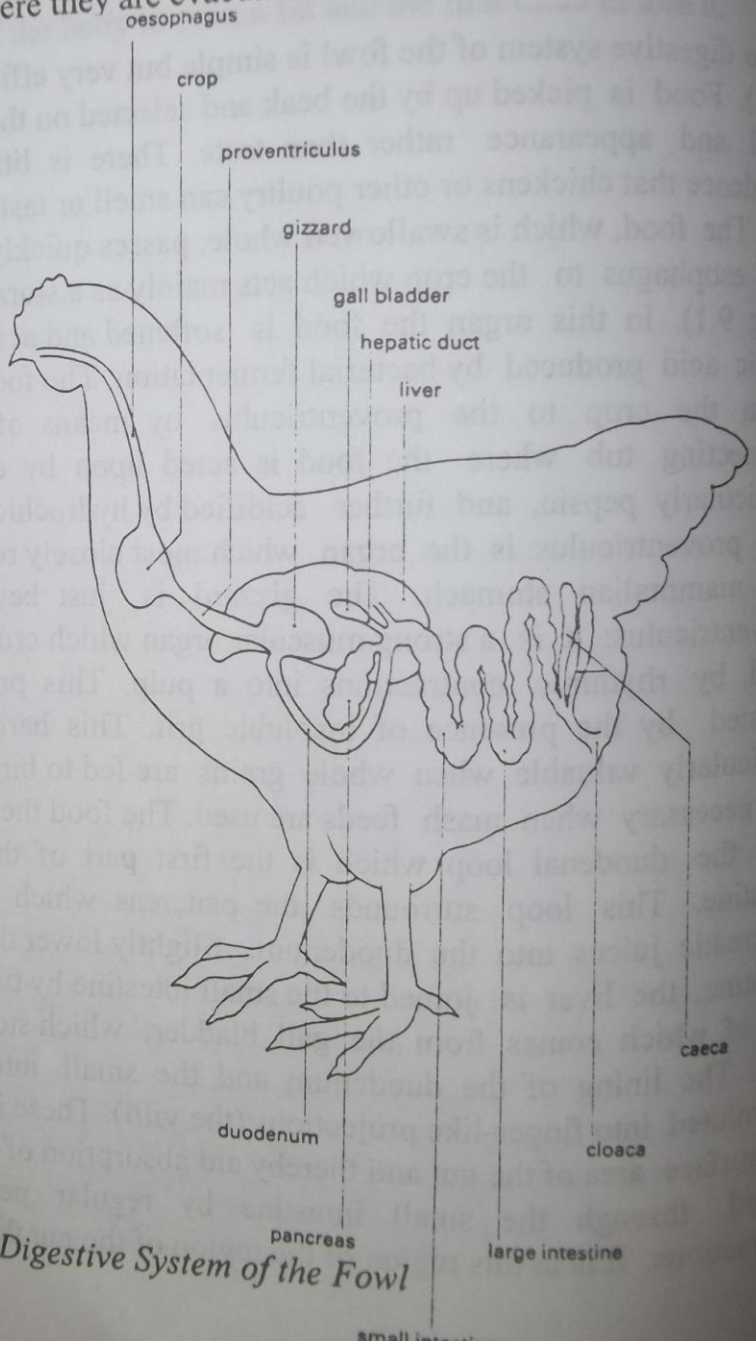

Fig 9.1 Digestive System of the Fowl

The digestive system of the duck is similar to that of the fowl. The bill of the suck is much larger than that of the fowl but the crop is smaller. When feeding from a trough ducks tend to push food out of it and onto the ground causing considerable wastage. Unlike the fowl, ducks have a small intestine that can absorb salt when the dietary intake of this mineral is high. This excess salt is then excreted by nasal glands. Fiber can be fermented in the cecae of ducks to produce volatile fatty acids. It is believed that improved digestion of fiber can be achieved by encouraging these organs to increase in size by feeding ducks diets containing high amounts of fiber.

The goose has no crop for grinding up food but there is an enlargement at the end of the gullet that serves as a temporary food storage organ.

Nutrient Requirements

Most of the research work on domestic poultry has been carried out on domestic chickens (Gallus domesticus). Thus most of the information on nutrition has been gathered for this species. Where differences between Gallus domesticus and the nutrition of other domestic poultry exist those differences will be pointed out. Otherwise the section on general nutrition can be taken to apply to all domestic poultry. Because poultry are monogastrics they are unable to manufacture essential amino acids or the B vitamins, and they cannot exist on high fiber diets. The diet of birds which are intensively housed and which gave access to neither soil, grass, nor sunshine mist contain the materials essential for the process of maintenance, production, and reproduction. The essential nutrients can be conveniently grouped under the following headings:

- water
- carbohydrate
- sources of energy

Lesson Ten

Egg and Egg Laying

Structure

The egg is made up of many complex parts. The study of these parts and their functions may be useful in dealing and working with eggs.

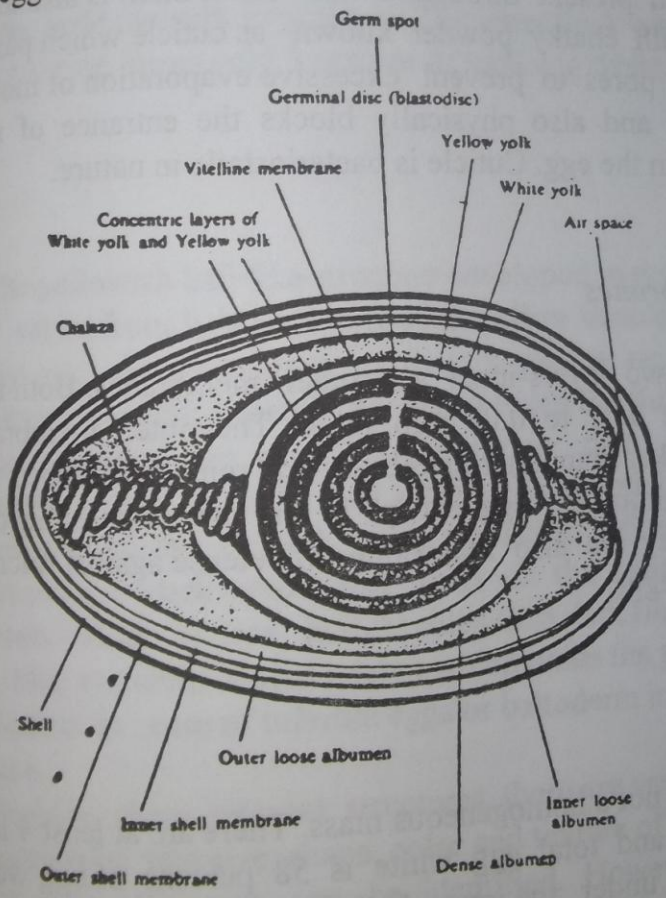

Fig 10.1 Egg Structure Showing Internal Parts

The following parts can be seen in the vertical section of egg (Fig 10.1)

Shell

It is an outer hard covering of egg amounting about 11 percent of total egg weight. It is mainly made up of calcium carbonate. It provides protective covering to liquid protein; besides it helps in gaseous exchange of developing embryo through 6000 to 8000 small pored present throughout the shell. Shell is also loosely covered with chalky powder known as cuticle which partially blocks the pores to prevent excessive evaporation of moisture from eggs and also physically blocks the entrance of micro organisms in the egg. Cuticle is bacteriostatic in nature.

Shell membranes

There are two layers-inner and outer membranes. Both layers together are 0.01 to 0.02 mm thick. The outer membrane is slightly thicker than inner membrane and remains attached to the shell throughout the egg except in the area where air-cell is formed. They are also major lines of defense against microbial invasion of eggs.

Albumen

Egg white is not a homogeneous mass. There are at least 4 layers of albumen and total egg white is 58 percent of egg weight. Immediately under the inner shell membrane, there is a layer of "thin albumen" which constitutes about 21 percent of total egg white. This layer is followed by a firm or thick layer of albumen. Some time it is also called outer thick layer. It is a major layer

and constitutes about 55 percent of total egg white. It envelops the yolk and inner thin layer of albumen and it also adheres to the shell at both the ends of eggs to gold the chalazae from both ends. Ovomucin thick white is responsible for firmness of this layer. Thin albumen is devoid of ovomucin. Slight greenish tint of thick due to the presence of riboflavin in it.

There is another layer of thin albumen below the thick albumen referred to as "inner thin albumen" which is about 17.5 percent of total egg white. This layer is followed by chalaziferous layer of thick albumen which surrounds the yolk. It is continuous with chalazae which are cord like structures. They help to hold the yolk in position. The inner thick white together with chalazae forms only 3 percent of total egg white.

Yolk

It is the yellowish ball like structure enveloped in egg white. The color varies from light pale to reddish yellow in color depending mainly on dietary pattern on dietary pattern on hens. Yolk constitutes a vitelline membrane which holds the fluid yolk mass together. Under the vitelline membrane there are 7 to 9 concentric rings of light and dark yolk materials which are formed due to the diurnal eating behaviors of hens. The only difference in dark and light rings is the concentration of pigments which is less in light rings than dark rings There is a neck like structure called latebra which holds the germinal disc (blastodisc in case of infertile eggs or baltoderm in fertile eggs) in place.

Besides, these internal structures, there are various external characteristics like size, shape, color and texture of egg shells by which an avian egg can be identified. However there are variations in these characters as influenced by heredity, physiological and environmental factors.

Natural Behavior of Egg Laying

In feral or wild poultry, a female which is about to lay a egg leaves the social group and normal home range and moves away to choose a nest site or to find the site chosen on a previous day. In domestic fowl, the male sometimes accompanies the female and it has been suggested that both are involved in nest site selection (McBride et al, 1969). An alternative suggestion, though, is that the male's interest in nesting is because mating is more effective after laying than before and in fact often occurs shortly after the female leaves the nest. Nest sites are usually well defined, in places such as the foot of a slope or under a bush, secluded from disturbance and enclosed for protection from predators. If loose material is available it is shaped into a hollow nest bowl, but poultry will also nest in a hollow scraped in the earth or on the flat ground (Duncan et al, 1978).

After an egg is laid, the female sits on it for only a short while before returning to normal behavior. This remains true even when several eggs have accumulated in the nest. When the clutch is complete, however, and the female bird only leaves the nest for about on hour each day to feed, drink and defecate; quail, however, leave the nest several times daily. Only when incubation starts do the embryos begin to develop, so development is synchronous even in eggs which were laid days or weeks apart. It is important that hatching of all eggs occurs over a short period because chicks are mobile soon after hatching and a brood hatched at different times would become separated.

M C Appleby et al (1992) *Poultry Production Systems*