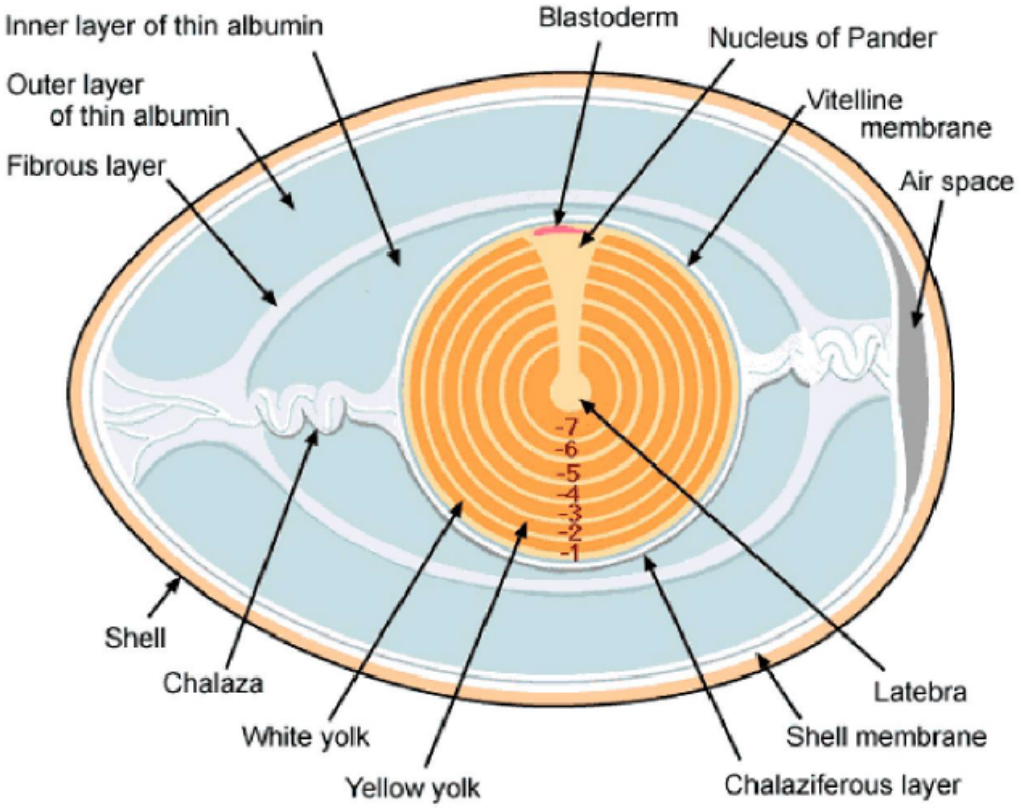
The Structure of a typical Ovum

Ovum is the female gamete. lt stores food required for the entire process of development in the form of yolk. lt has three important functions:
1. lt supplies a haploid set of chromosomes to the future embryo.
2. lt contributes almost all cytoplasm to the zygote.
3. lt supplies food to the developing embryo.

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 granularcytoplasm.



Organisation of Egg Cytoplasm

The cytoplasm of egg cell is known as ooplasm. lt is granular and contains in addition to the usual cellular organelles certain other inclusions like yolk, pigments and cortical granules. The peripheral layer of ooplasm is more viscous and gelatinous. lt is known as the egg cortex which is provided with many microvilli and cortical granules. The microvilli are formed by the outpushings of the plasmalemma and they help in transportation of substances from the outside into the ooplasm during the development of egg. The cortical granules are very small spherical bodies varying in diameter from 0.8 μm to 2μm . They are rnembrane bound and are formed from golgi complex. They contain homogeneous and granular mucopolysaccharides. Cortical granules are present in the eggs of sea urchins, frogs, fishes, bivalve molluscs, several annelids and certain mammals.

Yolk: Nutritive substances are stored in the cytoplasm of egg in the form of yolk or deutoplasm. This stored food is utilized by the embryo for its early development. The process of formation of yolk is known as vitellogenesis. The yolk is a complex material consisting of proteins, fats, carbohydrates, inorganic salts, vitamins, enzymes, pigments and water. The yolk may be called "protein yolk" when it has more proteins than lipids, or “fatty yolk" when it has more fat contents than the proteins. Most animal eggs contain both kinds of yolk. Since the yolk is heavier, large quantities of yolk, such as those of the frog and chick, the accumulation of yolk in one region is so marked that they are known as telolecithal eggs. In eggs containing lesser amount of yolk, like those of Amphioxus and man, the yolk is distributed more uniformly, hence they are known as isolecithatal or homolecithal.

Pigment granules are present in the cytoplasm of eggs of many species. The granules may be brown, black, red, yellow, green or- grey in colour. As the pigment granules are not common to all eggs, they do not play any significant role in development.

Polarity

The constituents of egg are not uniformly distributed throughout the cytoplasm. These are distributed in such a way that two poles distinct can be identified in the egg. These pores are known as animal pole and vegetal pore. The cytoplasm is concentrated in the upper portion or animal hemisphere and the yolk material is concentrated in the lower portion or vegetal hemisphere. A plane passing through these two poles constitute the polar axis. The nucleus is always located in the polar axis, more or less towards the animal pole. The yolk shows a gradation from the animal pole towards the vegetal pole. There is also a metabolic gradation along the polar axis. Metabolic processes are highest at the animal pole and progressively diminish towards the vegetal pole.

Egg Membranes

The eggs are well protected by egg membranes. The membranes are produced either by the egg itself or by the follicle cells of the ovary or by the genital ducts (oviduct) of the female, mother.

Accordingly, the egg membranes are classified into three types. They are:

1. Primary membranes 2. Secondary membranes and 3. Tertiary membrane.

I. Primary membranes: The membranes secreted by egg cytoplasm (ooplasm) constitute the primary membrane. They are closely attached to the surface of the egg. The primary membranes are named differently in the different animals. They are

a. Plasma Membrane

It is the membrane covering the egg immediately It over it. is found in all the eggs in structure, It resembles the plasma membrane of a cell.

b.Vitelline Membrane: it is closely attached to the plasma membrane of egg. Commonly found in Egg of Amphioxus. molluscs. Echinoderms, amphibians birds etc It is very thin and and transparent. It is formed of mucopolysacharide and fibrous protein. The space formed between it and the plasma membrane is called perivitelline space filled with a fluid called perivitelline fluid.

c. Chorion: It is found in the eggs of lower chordates like fishes (styela)It is a product of surface ooplasm

d.Zona Radiata

The egg of the shark Scyllium canicula, has two primary membranes produced by the surface ooplasm. The outer membrane is the vitetlline membrane and the inner membrane has a radiating appearance and hence called zona radiata The eggs of teleost fishes are also covered by zona radiata.

e.Zona Pellucida

All mammalian eggs are surrounded by a membrane called zona pellucida is also named as zone radiata. It is so named because it gives a striated appearance under the microscope. The striations are due to the presence of microvilli and macrovilli (desmosomes) in this zone. The microvilli are produced by the surface of the egg and microvilli are produced by follicle cells. They protrude into the zona pellucida.

II. Secondary Membranes

The secondary membranes are produced by the follicle cells (cells found around the developing oocytes) of the ovary. These membranes are usually tough and impermeable. The secondary membranes are as follows:

a. Chorion

This is a common outer covering in the eggs of insects, ascidians and cyclostomes (Myxine).It is found outside the vitelline membrane. As the chorion is tough and

impermeable. It is provided with one or more openings called micropyles through which the sperms enter the egg.

b. Corona Radiata It is found in mammalian eggs. This membrane is formed of a layer of follicle cells. The cells are radially arranged around the zona pellucida

III.Tertiary Membranes

The tertiary membranes are produced by the oviduct.

a. White Albumen

It is found in the egg of hen. It is found outside the vitelline membrane. It is formed of three layers-inner less dense albumen, a middle dense albumen and an outer less dense albumen. The albumen is formed of water and protein

b. Shell Membrane: The shell membrane is formed around the albumen in the egg of hen. It is a double membrane. The two membranes adhere closely and are separated by an air space ar the blunt end of the egg. This membrane is formed of keratinc.

c.Shell: The shell is the outer covering of land animals eggs. It is formed of calcium carbonate. It is white or brown in colour. It contains as many as 7000 minute pores. These pores are 0.04 to 0.05 mm in diameter. They are filled with a proteinous substance called collagen.

d. Jelly Coat: The amphibian eggs are surrounded by a gelatinous covering called jelly coat

e. Mermaid's Purse: It is the egg case of some cartilaginous fishes. It is a protective hard shell secreted by the shell glands present in the oviduct. The shape of the purse varies from group to group. Generally, it is rectangular in shape. The corners of the shell are drawn out into four long twisted elastic filaments which serve to attach the eggs to sea weeds. In dog-fish Chiloscyllium, development is completed within purse.