Types of Eggs
Egg Membranes

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13.2.1 Types of Eggs on basis of Yolk Present

The yolk present in the egg is important as a nutritive material for the developing embryo.Furthemore, the amount and distribution of yolk determines the type and structure of the egg, and it also influences the rate and pattern of its cleavage. In other words, cleavage depends, to a large extent, upon the amount, distribution and orientation of yolk in the egg. In general yolk inhibits cleavage. When one pole of the egg is rich in yolk it is known as **vegetal pole** and the opposite pole is known as **animal pole**. Usually the animal pole has a sparse distribution of yolk and the cell's nucleus is present and positioned in the animal pole.

A) The eggs in various animal groups based on the amount of yolk, are of the following types (Fig.13.2):

i) **Alecithal or yolkless eggs** as in the eutherian mammals. (Fig.13.2 A). In the absence of yolk the nutrition is provided by the placenta.

ii) **Microlecithal or oligolecithal eggs** have little yolk which is in the form of granules, e.g.,echinoderms, *Amphioxus*, molluscs (except cephalopods), annelids, flatworms (Fig.13.2 B).

iii) **Mesolecithal eggs** have moderate amount of yolk, e.g. tunicates and amphibians (Fig.13.2 C). Since the eggs of these animals do not have much yolk they usually have larval stages that are voracious feeders.

iv) **Megalecithal or macrolecithal or heavily yolked eggs**, e.g. cephalopod molluscs, bony fishes, reptiles, birds and egg laying mammals. The yolk occupies almost the whole of the interior of the egg with a small disc-shaped clear area of cytoplasm near the animal pole where the germinal vesicle (or nucleus) lies. Most of such eggs are large sized and the entire nutrition for the embryo is provided by the yolk (Fig.13.2 E).

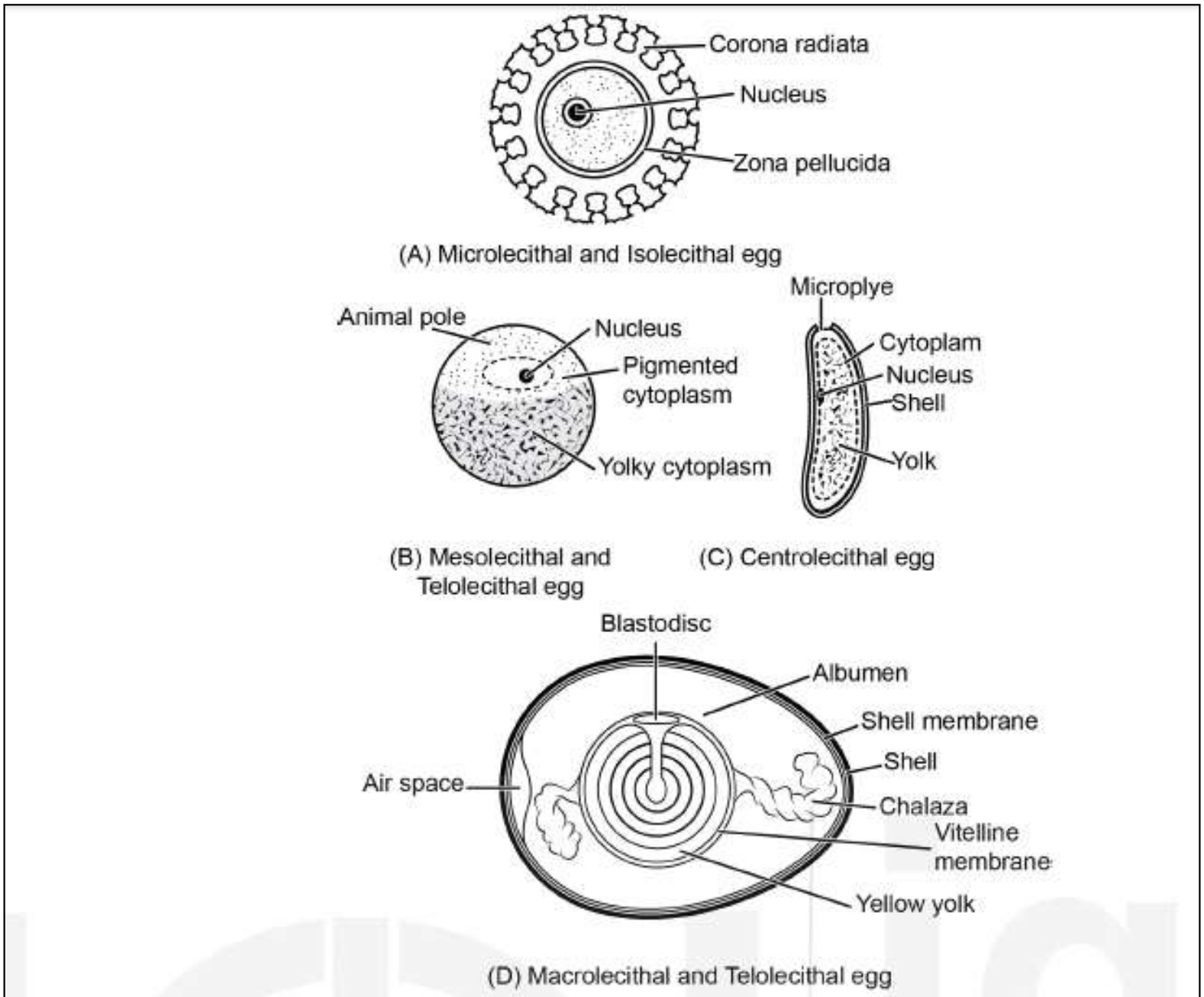

Fig. 13.2: Different types of eggs. A) microlecithal and isolecithal egg; B) mesolecithal and telolecithal egg; C) centrolecithal egg; D) macroleithal egg of hen.

B) The eggs can be categorized as follows on the basis of how yolk is distributed in them:

i) **Isolecithal egg** in which the yolk is more or less evenly distributed yolk e.g., (echinoderms, *Amphioxus*, molluscs (except cephalopods), annelids. (Fig.13.2 B)

ii) **Telolecithal egg** in which the yolk granules or yolk mass occupying the vegetal hemisphere is highly telolecithal as the yolk fills up almost the entire interior of the egg leaving only a small disc of clear cytoplasm containing the germinal vesicle (nucleus) near the animal pole of the egg. (Fig.13.2 C, D). Such types of eggs are seen in fish, reptiles and birds.

iii) **Centrolecithal egg** – In insects the yolk granules are concentrated in the interior of the egg whereas the cytoplasm is distributed as a thin peripheral layer around the yolk. Cell division takes place only in this rim of cytoplasm. (Fig.13.2 E).

12.4.4 Egg Envelopes of Vertebrates

All ova like any other cell, are covered by a **plasma membrane** (**PM**) also referred to as oolemma **or cytoplasmic membrane** which consist of two layers. The collective thickness of the two layers is about 50 A° (unit membrane) and these two layers are separated by a gap of 60 A°.In addition to possessing the oolemma the eggs are also surrounded by special egg envelopes or extracellular coats which develop during the course of oogenesis. These egg membranes can be classified according to their site of origin as primary, secondary or tertiary types.

I. Primary Egg Envelopes

Primary egg envelopes develop in the ovary between oocyte and follicle cells in the space occupied by the interdigitating microvilli. Such envelopes have been named variously in different animals and given below:

a) The **vitalline membrane** or primary envelope may be a non cellular, transparent layer of mucoprotein, supplemented by extensions of membrane glycoprotein from the plasma membrane and by proteinaceous structures that attach the vitelline envelope to the membrane. This membrane is essential for species- specific binding of the sperm and is found in insects, molluscs, amphibians and birds.

b) In tunicates and fishes, the primary envelope is known as **chorion**. In many sharks and bony fishes the primary envelope has a striated appearance due to the degraded microvilli of the growing oocyte and is referred to as zona radiata. The perforation in the zona radiata becomes the micropyle through which the spermatozoa can enter the egg.

c) In mammals, the primary egg envelope is called the **zona pellucida**. It is an unstriated and modified layer formed as a result of joint efforts of egg and follicle cells (Fig. 12.13). While escaping the Graafian follicle the mammalian oocyte carries on the surface of zona pellucida a layer of follicle cells known as **corona radiata.**

The primary envelopes usually stick closely to the egg surface. These later on participate in the formation of the fertilization membrane.

II. Secondary Egg Envelope or coat

The secondary egg envelope**s** are secreted outside the primary egg envelope by the layer of follicle cells that surrounds the oocyte and are referred to as:

a) Chorion in insects, ascidians and cyclostomes which is in the form of a chitinous shell in these animals.

b) Corona radiata in mammals.

c) Outer vitelline membrane in birds.

III. Tertiary Egg Envelope

The tertiary egg envelope is secreted by oviducts and other accessory parts of the genital organs while the egg passes through them from the ovary to the exterior, towards the cloaca.

a) In ovoviviparous sharks the tertiary egg envelope surrounding the egg is in the form of a hard shell which is secreted by shell glands of the oviduct. The shell is drawn out as twisted horns which help to entangle the egg among sea weeds.

b) In amphibians, the tertiary egg envelope layer is in the form of **a jelly or albumin layer** which surrounds the egg and protects it from adverse effects of sun rays, abrasion as well as from predators (because of its bad taste). The jelly absorbs water and swells up (Fig.12.15).

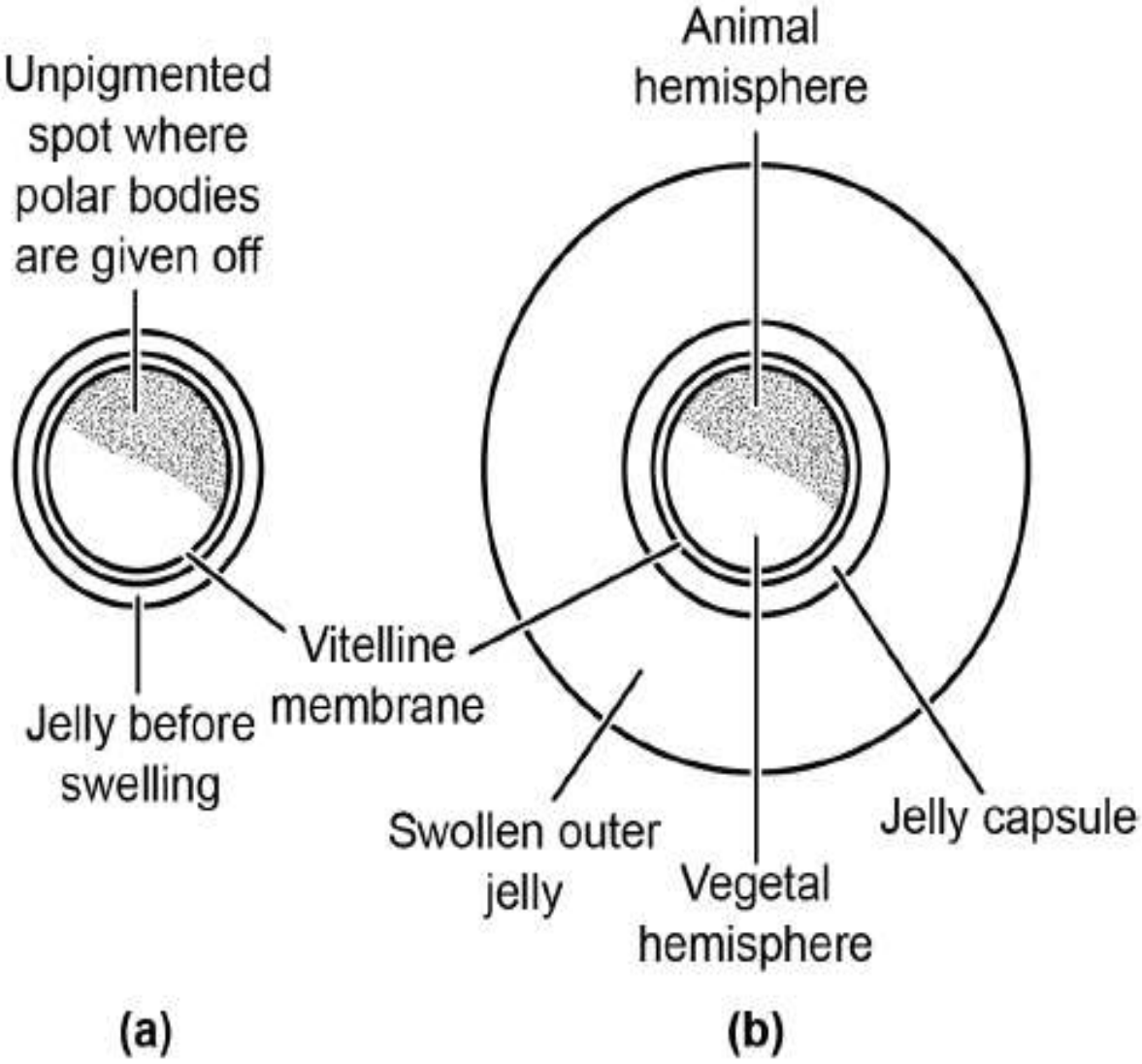

Fig.12.15: An amphibian egg a) as taken from oviduct and; b) sometime after in spawning in water with swollen jelly membrane.

In birds, reptiles and monotremes, the tertiary envelope includes the egg white or albumin as well as its chalazae which is the twisted albumin in form of spiral strands. Both of these surround the yolk of the ovum and are covered by inner and outer shell membranes which are in close contact with one another and are also known as the tertiary envelope. The two shell membranes are enclosed by the outermost calcareous shell which is porous (Fig 12.16). The calcareous egg shell is also a tertiary envelope. The egg shell of birds is elastic and compressible when the egg is laid but it hardens on exposure to the atmosphere.

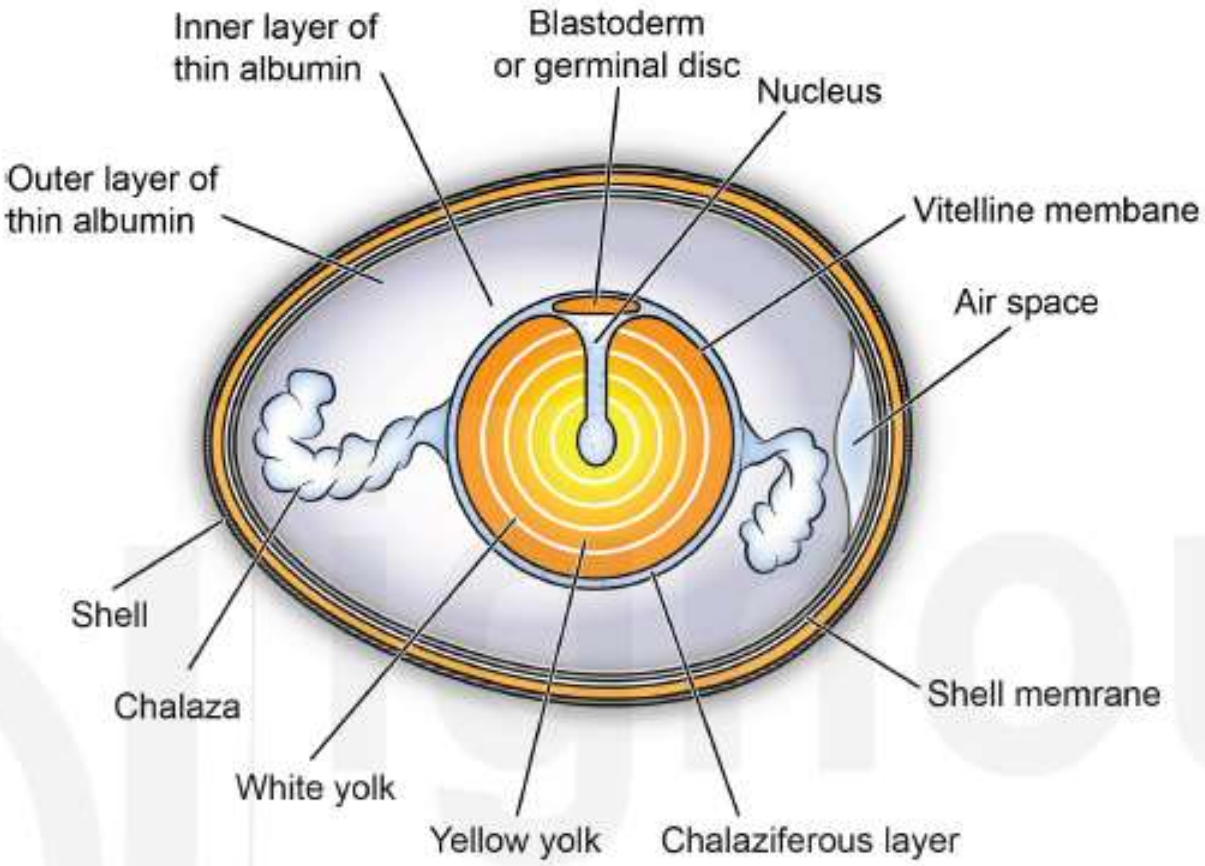

Fig.12.16: A median longitudinal section of hen's egg to show the egg envelopes.