

## Quadrant II – Transcript and Related Materials

**Programme:** Bachelor of Science (Third Year)

**Subject:** Zoology

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**Paper Title:** Developmental Biology

**Unit:** 1- Introduction

**Module Name:** Egg membranes

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### Notes

#### Egg Membranes

##### Introduction to Egg Membranes

The mature egg is covered by a cell membrane or plasmalemma.

In most animals, this membrane is surrounded by certain special protective accessory structures called egg envelopes or egg membranes, which are produced outside the plasma membrane of the egg. These egg membranes vary in different animal groups and often reflect the adaptations made by the animal to ensure development of the young in its particular environment.

These membranes are produced either by the egg itself or by the follicle cells of the ovary or by the genital ducts (oviduct) of the mother.

There are many ways of classifying these membranes but the simplest way is to group them according to their origin.

##### **Classification of egg membranes**

Depending on their origin, these may be subdivided into three groups.

- 1) Primary egg membranes
- 2) Secondary egg membranes
- 3) Tertiary egg membranes

##### **1) Primary egg membranes**

Formed in the ovary and laid down between the egg plasma membrane and follicle cells.

Formed either by the ovum or follicle cells and sometimes by the cooperative effort of both.

- a) Vitelline membrane
- b) Zona radiata
- c) Jelly coat

#### **a) Vitelline membrane**

Non-cellular, transparent layer of mucoprotein, forming an extracellular matrix which is both fibrous and amorphous.

Much thicker and stronger than the underlying fine plasma membrane of the egg and has tensile and elastic properties

**Vitelline membrane** has been given various names in different animals.

In **amphibians and birds**, it is in close contact with the ooplasmic surface until the egg is fertilised, at which time it separates from this surface forming a tough **fertilization** membrane.

In **fish**, this membrane is called **chorion**; in **reptiles and mammals**, it is given the name **zona pellucida**

#### **b) Zona radiata:**

The primary envelope of shark, some bony fishes, some amphibians and reptiles have striated appearance and is called zona radiata.

It represents the degrading microvilli of the growing oocyte.

#### **c) Jelly coat:**

In Echinoderms and many other eggs of marine invertebrates, the primary egg envelope is a much thicker structure of **jelly coat**.

All these primary egg membranes adhere closely to the surface of the oocyte, but at later stage a space filled with a fluid may appear between the egg plasma membrane and primary egg membrane. This space is called **perivitelline** space.

### **2) Secondary egg membranes**

The secondary egg membrane is secreted outside the primary egg membrane by a layer of follicle cell that surrounds the oocyte.

It occurs in the form of a chitinous shell surrounding the egg in insects, ascidians and cyclostomes and is called **chorion**

In many insects, the surface of the chorion shows a complicated sculpture which is typical of each species. No secondary egg membranes are found in amphibians, reptiles, birds and even mammalian eggs.

However, in mammals when a Graafian follicle ruptures and releases the mature ovum, the egg carries with it for some distance down the fallopian tube, a layer of follicle cells.

These cells are columnar in shape and arranged radially in a single layer, called **corona radiata**, around the ovum, outside the zona pellucida.

### **3) Tertiary egg membranes:**

These are secreted by the cells of the oviduct as the egg travels down the duct toward the cloaca.

The tertiary egg membranes involve the albumen layers, jelly coats, shell membranes and the shell itself.

a) In oviparous sharks and rays, the egg is surrounded by albumen and hard horny capsule of a complicated shape. This is called **the mermaid's purse**.

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 the sea weeds.

The horny egg capsule is secreted by shell glands of the oviduct.

As the egg of the amphibian spirals down the oviduct, three uniform layers of albumen(jelly) are deposited around it. The inner layer is a thin one and most viscous; the outer, wide and more fluid; the middle layer intermediate.

When this egg is deposited in water, the jelly absorbs water and swells

These jelly envelopes hold the eggs together in masses, protect the eggs from infection, insulate the eggs, make them unappetizing to the predators since they are tasteless and anchor the eggs to twigs or plants.

In reptiles and birds, five tertiary membranes make up the envelopes of the egg. External to vitelline membrane are added the white of egg(albumen), two shell membranes and a porous shell.

The albumen of the egg of birds is differentiated into two distinct layers- a dense inner layer and a thin outer layer.

Next to the egg-white come two layers of shell membranes which contain fibres of keratin matted together. Both shell membranes enclose a large air space towards the blunt end of the egg.

The outermost layer is calcareous shell which is pierced by large number of fine pores filled by an organic substance related to collagen.

### **Significance of egg membranes**

The extraneous envelopes of different oviparous vertebrates provide protection to the contents of eggs of developing embryos from different ecological hazards

(variable pH, temperature variations, radiations, pollution, danger of desiccation etc.) and from mechanical injuries.

Secondarily, they may prevent self-fertilization as in ascidians or may provide buoyancy to the eggs as in amphibians and other chordates.

Even in viviparous mammals, the extraneous coat such as zona pellucida, is found (1) to check polyspermy (2) as a means of preventing egg fusion (3) maintaining normal cleavage of the egg following fertilization.