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PG & Research Department of Zoology

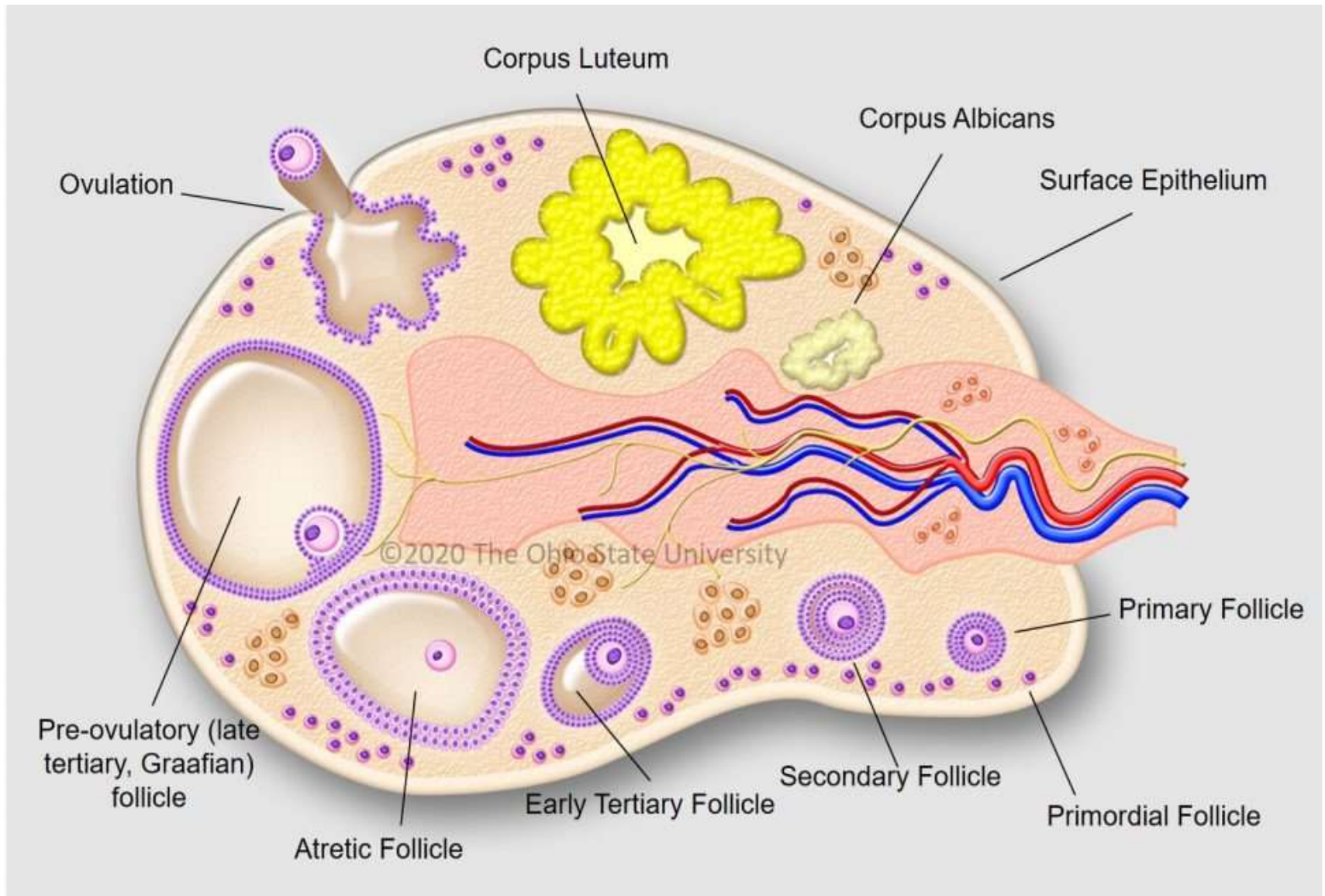
ANATOMY OF OVARY AND OOGENESIS

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- ❖ The ovaries are the female pelvic reproductive organs that house the ova and are also responsible for the production of sex hormones.
- ❖ They are paired organs located on either side of the uterus within the broad ligament below the uterine (fallopian) tubes.
- ❖ The ovary is within the ovarian fossa, a space that is bound by the external iliac vessels, obliterated umbilical artery, and the ureter.
- ❖ The ovaries are responsible for housing and releasing ova, or eggs, necessary for reproduction.
- ❖ At birth, a female has approximately 1-2 million eggs, but only 300 of these eggs will ever become mature and be released for the purpose of fertilization.

Anatomy of Ovary

- ❖ The ovaries are small, **oval-shaped**, and **grayish in color**, with an uneven surface.
- ❖ The actual size of an ovary depends on a woman's age and hormonal status; the ovaries, covered by a modified peritoneum, are approximately **3-5 cm** in length.
- ❖ The ovaries are covered on the outside by a layer of simple cuboidal epithelium called **germinal (ovarian) epithelium**.
- ❖ Underneath this layer is a dense connective tissue capsule, the **tunica albuginea**.
- ❖ The substance of the ovaries is distinctly divided into an **outer cortex** and an **inner medulla**.



- ❖ The cortical parenchyma is composed of **follicles** (oocytes and follicular cells), **interstitial cells** and **collagenous connective tissue stroma**.
- ❖ The cortex appears more dense and granular due to the presence of numerous ovarian follicles in various stages of development.
- ❖ The ovarian medulla contains large arteries and veins, lymphatics, nerves embedded in a loose collagenous matrix.
- ❖ Each of the follicles contains an oocyte, a female germ cell.
- ❖ The medulla is a loose connective tissue with abundant blood vessels, lymphatic vessels, and nerve fibers.

- ❖ **Primordial follicles** contain a primary oocyte and are surrounded by a single layer of flattened follicular cells.
- ❖ **Primary follicles** still contain a primary oocyte but the follicular cells become more cuboidal and are now known as granulosa cells.
- ❖ **Secondary follicles** start develop spaces between granulosa cells that coalesce to eventually form a large space called the follicular antrum.
- ❖ **Graafian (tertiary, mature) follicles** are large preovulatory follicles which bulge from the surface of the ovary.

Oogenesis

- ❖ Oogenesis refers to the development of oocytes within the ovary.
- ❖ The process can be divided into three stages – fetal, prepuberty (resting stage) and puberty.
- ❖ During fetal oogenesis, the sex cords break down and the germ cells undergo enhanced mitosis.
- ❖ During Puberty Primary oocytes enter a resting phase in which full maturation does not occur until stimulation by gonadotrophic hormones takes place.
- ❖ Large numbers of post mitotic germ cells (oogonia) and primary oocytes were dead in the prenatal post puberty period.

Oogenesis divisible into following three phases

1. Multiplication Phase:

- ❖ The primary germinal cells of the ovary with diploid number of chromosomes ($2n$) divide several times mitotically so as to form a large number of daughter cells known as oogonia.

2. Growth Phase:

- ❖ In the primary oocyte, large amount of fats and proteins becomes accumulated in the form of yolk and due to its heavy weight (or gravity), it is usually concentrated towards the lower portion of the egg forming the vegetative pole.

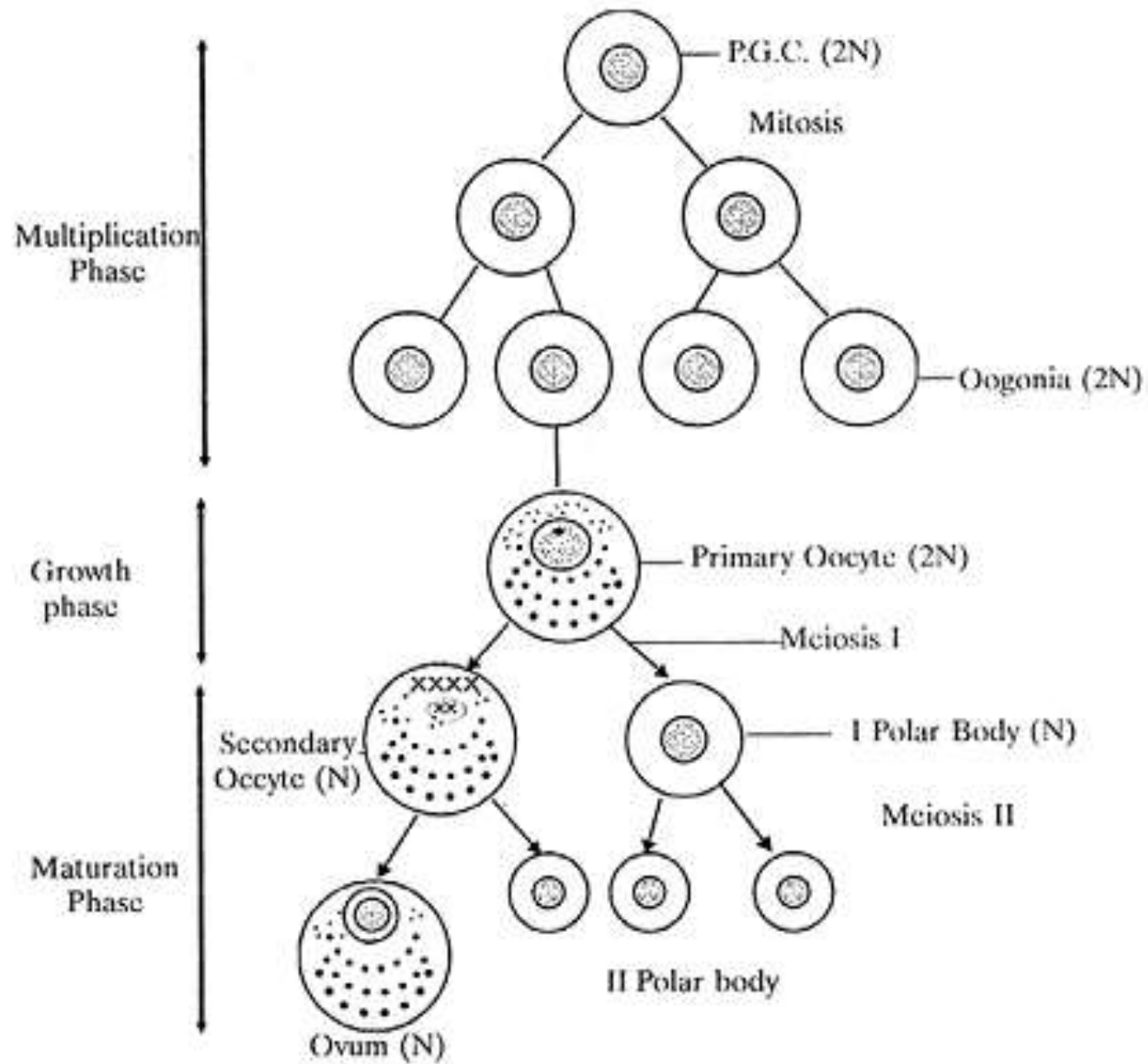
- ❖ The portion of the cytoplasm containing the egg pro-nucleus remains often separated from the yolk and move towards the upper side of the egg forming the animal pole.
- ❖ The cytoplasm of the oocyte becomes rich in RNA, DNA, ATP and enzymes. Moreover, the mitochondria, Golgi apparatus, ribosomes, etc., become concentrated in the cytoplasm of the oocyte.
- ❖ During the growth phase, tremendous changes also occur in the nucleus of the primary oocyte.
- ❖ The nucleus becomes large due to the increased amount of the nucleoplasm and is called germinal vesicle.

3. Maturation Phase:

- ❖ The primary oocyte undergoes two successive divisions by meiosis.

(i) First maturation division:

- ❖ The first division two unequal daughter cells are produced.
- ❖ The large cell is called secondary oocyte containing haploid (n) set of chromosomes and entire amount of cytoplasm.
- ❖ The smaller cell is called first polar body or polocyte containing 'n' number of chromosomes and no cytoplasm.



(ii) Second meiotic division:

- ❖ The haploid secondary oocyte and first polocyte pass through the second meiotic division.
- ❖ Due to the second meiotic division, the secondary oocyte forms a mature egg and a second polocyte.
- ❖ By the second meiotic division, the first polocyte also divides into two secondary polocytes.
- ❖ These polocytes ooze out from the egg and degenerate while the haploid egg cell becomes ready for the fertilization.

- ❖ Oogenesis is followed by the formation of protective coverings called egg membranes.
- ❖ Primary membrane is formed surrounding the plasma membrane of ovum and is secreted by the ovum itself.
- ❖ It is called vitelline membrane in frog and zona pellucida in rabbit. The secondary membrane called chorion is formed from ovarian follicle cells.
- ❖ The tertiary membranes are secreted in oviduct when the ovum passes from ovary to outside.
- ❖ The egg white (albumin), calcareous shell etc. come under this category

Types of Eggs

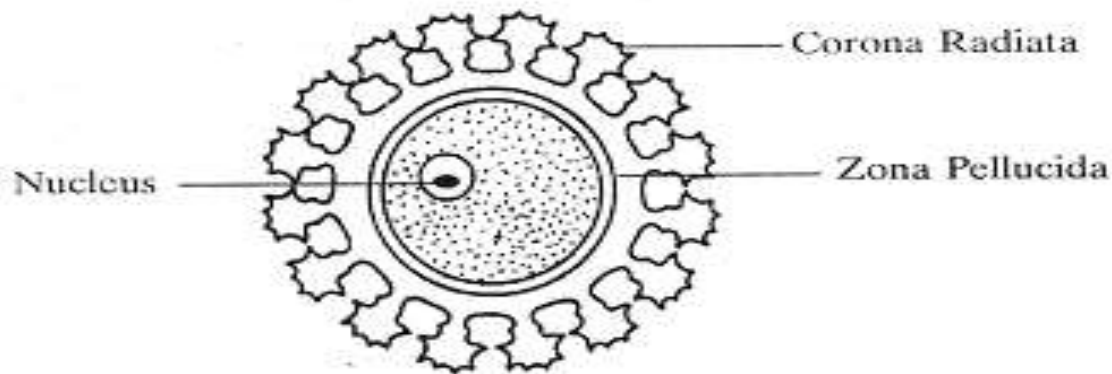
The following points highlight the two types of eggs. The types are:

1. Eggs Based on Quantity of Yolk
2. Eggs Based on Distribution of Yolk in Cytoplasm
3. Presence or absence of hard shell
4. On the basis of development

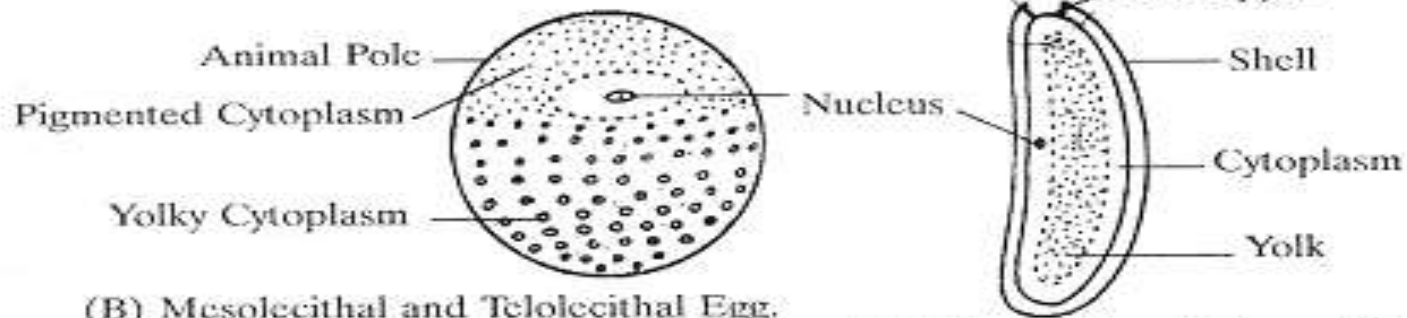
I. Eggs Based on Quantity of Yolk:

1. Microlecithal Eggs:

- They contain very small amount of yolk, e.g. eggs of Sea urchin, Herdmania, amphioxus.
- The eggs of man contain very little amount of yolk, hence human egg is alecithal (almost free of yolk).

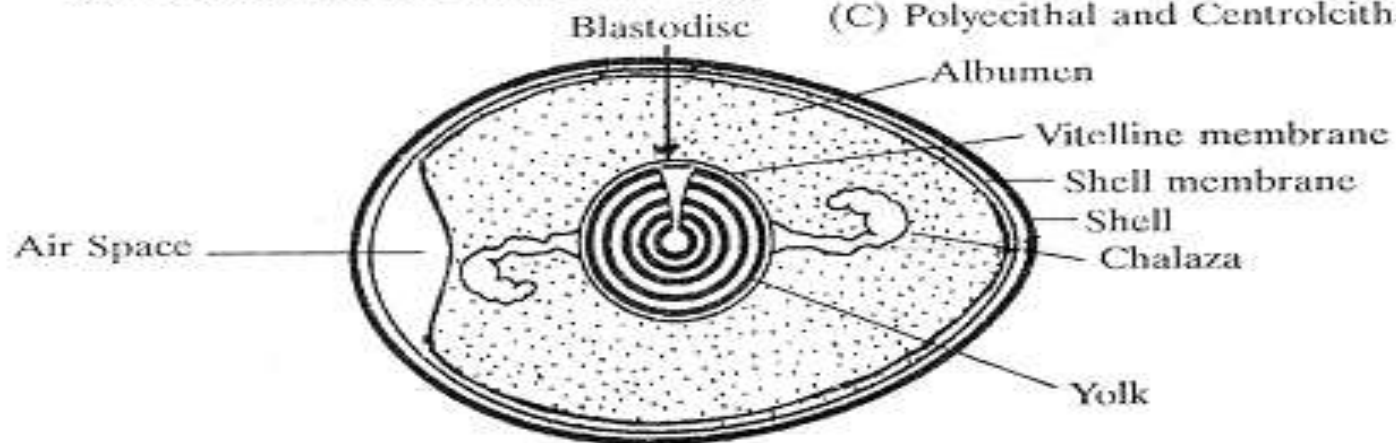


(A) Microlecithal and Isolecithal Egg.



(B) Mesolecithal and Telolecithal Egg.

(C) Polycythical and Centrolcithal Egg.



(D) Macrolecithal and Telolecithal Egg.

2. Mesolecithal Eggs:

They contain moderate amount of yolk, e.g., eggs of lamprey, lung fish, frogs and toads.

3. Macrolecithal (Polylecithal) Eggs:

They contain large amount of yolk, e.g., eggs of insects, sharks, bony fishes, reptiles, birds and egg laying mammals.

II. Eggs Based on Distribution of Yolk in Cytoplasm:

1. Homolecithal Eggs:

Yolk is uniformly distributed, e.g. eggs of annelids, molluscs, echinoderms and protochordates.

2. Telolecithal Eggs:

Yolk is concentrated in the vegetal half, e.g. eggs of amphibians.

3. Meiolecithal Eggs:

Yolk is very large which occupies nearly the entire ooplasm, leaving free only a small disc like area of cytoplasm for the nucleus, e.g., eggs of reptiles, birds and egg laying mammals.

4. Centrolecithal Eggs:

Yolk is localized at the centre, e.g. eggs of insects.

III. Presence or absence of hard shell

1. Cleidoic eggs - Such eggs are covered by hard shell for protection which is permeable for gases. Yolk present in sufficient quantity. eg. Reptiles and birds.

(ii) Non cleidoc egg - They are without shell and these develop in aquatic medium and uterus of female. eg. amphioxys, mammals, frog and hardmania.

IV. On the basis of development

(i) Determinate or Mosaic Eggs

- In these types of eggs before fertilization determined the different parts of embryo called the mosaic eggs.
- If any part remove the eggs the related organs does not originate in the embryo.
- After first cleavage both blastomere are separate than develop the half embryo. eg. Polyclade, Nematode, Annelids, Molluscs and Ascidian.

Polarity of the eggs:

- All types of eggs have the polarity but it is highly marked in telolecithal eggs.
- The two poles are designated as vegetal pole and animal pole.
- An imaginary line which passes through the centre of the animal pole to that of the vegetal pole is called animal-vegetal axis or median axis or polar axis.
- The animal pole indicates the future anterior region of the developing embryos or the future anterior or head region of the animals and the vegetal pole develops as the posterior region of the animals.

THANK YOU