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B.Sc. Zoology Part II

EMBRYOLOGY: DEVELOPMENT AND FUNCTION OF EXTRA-EMBRYONIC MEMBRANES IN CHICK

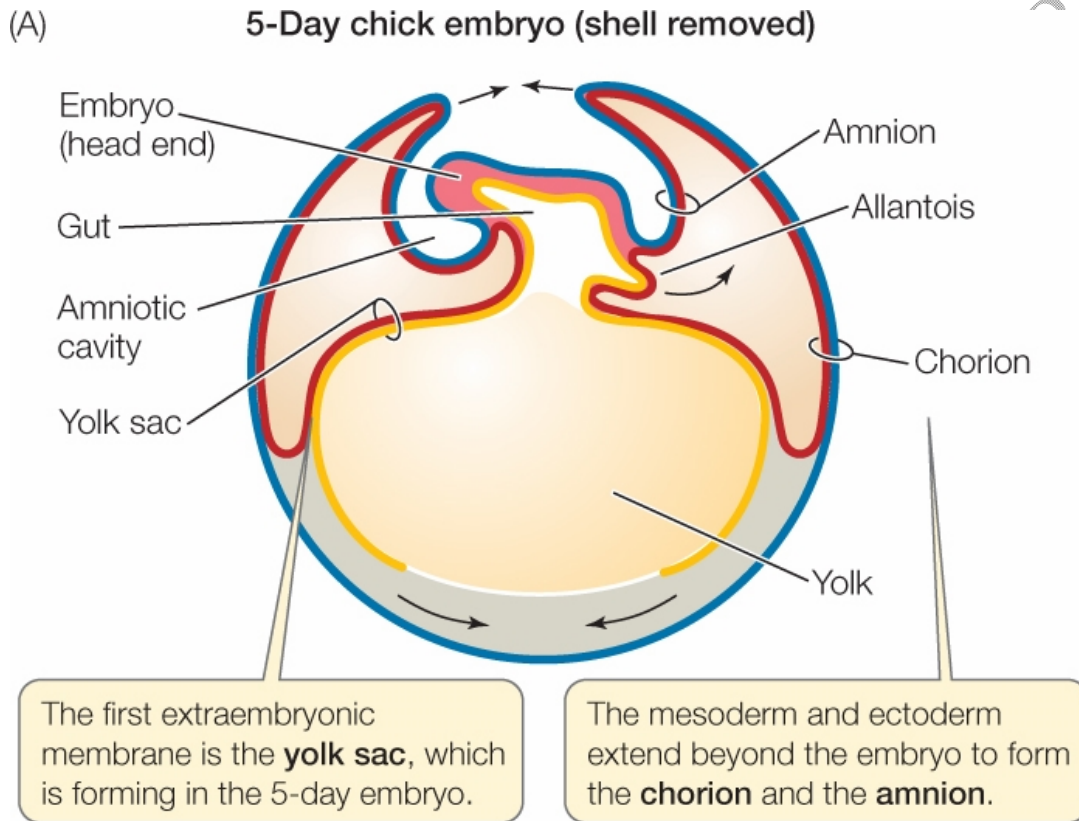
INTRODUCTION

- ✓ Area pellucida of the blastoderm is the real embryonic part in the chick embryo.
- ✓ Area opaca of the blastoderm constitutes extra-embryonic parts.
- ✓ It develops into extra embryonic membranes and blood vessels.
- ✓ As embryo at this stage is called **foetus**, extra-embryonic membranes are also called **foetal membranes**.
- ✓ These are of four types in chick embryo namely, the **yolk sac**, the **amnion**, the **chorion** or **serosa** and **the allantois**.

1. THE YOLK SAC

- ✓ The yolk sac is the first extra-embryonic membrane to make its appearance in the chick embryo.
- ✓ In the early stage the floor of the gut is formed by the yolk mass lying below it.
- ✓ The **splanchnopleure** of the chick grows over the yolk surface to form a sac like investment for the yolk instead of forming a close gut.
- ✓ Up to about 16 hours of incubation, the gut in chick embryo is represented by a round cavity beneath the primitive streak.
- ✓ During the spreading of the extra-embryonic splenchnopleure around the yolk, intra-embryonic splenchnopleure undergoes a series of changes which leads to the establishment of a completely walled gut in the body of the embryo.
- ✓ A small enteric pocket develops into the developing head as the fore gut at about 24 hours of incubation.
- ✓ A sac like hind gut develops with the formation of the tail at about 48 hours of incubation.
- ✓ The undifferentiated part of the gut lying between the fore gut and hind gut is called mid gut.
- ✓ The fore gut and hind gut increase in extent at the expense of mid gut.

- ✓ Hence, the mid gut is diminished finally except at the point where it retains connection with the yolk sac through an inverted funnel like duct called **yolk stalk**.
- ✓ The opening of mid gut into the yolk sac is called **umbilicus**.
- ✓ The yolk sac reduced gradually due to spreading of the **blastoderm**.
- ✓ The yolk sac is so much reduced that two or three days before hatching it is finally incorporated with the tissues of the small intestine and is represented only in the form of a protuberance from the small intestine.



Fig; THE YOLK SAC

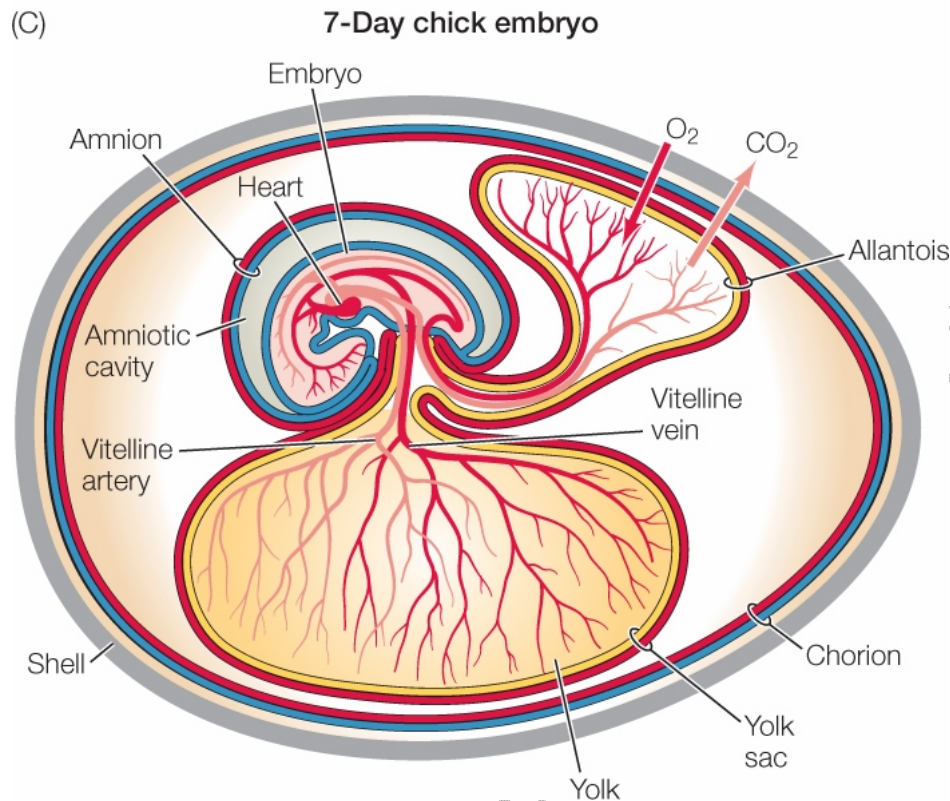
FUNCTION OF YOLK SAC

- The yolk is directly used as food by the early embryo.
- It is broken down into diffusible substances with the help of enzymes secreted by the endoderm of the yolk sac.
- These substances are collected by the vitelline veins and carried to the heart.
- It sends them to the different parts of the embryo and extra-embryonic structures.

2. THE AMNION AND 3. THE CHORION

- ✓ These two extra-embryonic membranes develop together hence are considered collectively.

- ✓ Both are derived from the extra-embryonic somatopleure.
- ✓ The amnion encloses the embryo as a saccular investment.
- ✓ The amniotic cavity formed between the amnion and embryo remains filled with a saline solution called amniotic fluid.
- ✓ Amnion keeps the embryo suspended in the amniotic fluid and provides opportunities to change its shape and position.
- ✓ The first indication of amnion formation appears in chick embryo at about 30 hrs. of incubation.
- ✓ On increase in weight due to growth, the head of the embryo begins sinking into the underlying yolk mass as well as it is pushed forward also.
- ✓ At the same time, the extra-embryonic somatopleure lying anterior to the head is thrown into a fold, the head fold of the amnion.
- ✓ This fold bends backward over the head and covers it as a hood.
- ✓ The margins of this fold prolong backward along the two sides of the embryo and form lateral amniotic folds.
- ✓ These come above the embryo and fuse together along the antero-posterior direction.
- ✓ Shortly after the second day of incubation the amniotic tail fold appears from the posterior (the tail bud) of the embryo.
- ✓ It grows forward over the embryo in the same fashion as backward growth of the amniotic head fold. When these folds reach somewhat above the embryo, the formation of **serosa** being as the bending of these layers outwards.
- ✓ This involves doubling of the somatopleure itself, however its growth above the embryo is continued.
- ✓ As a result of continuous growth, the bends of head and tail folds meet and fuse.
- ✓ This leads to the formation of a dome above the embryo.
- ✓ The place of union of the amniotic folds is marked by a scar and is called the **sero-amniotic connection**.
- ✓ The rapid peripheral growth of the somatopleure brings the serosa about the yolk sac. By the time the former envelops the latter.
- ✓ With the completion of the union of amniotic folds and formation of envelop round the yolk sac by chorion two separate layers namely an inner amnion and an outer chorion are formed round the embryo.
- ✓ The amnion is transparent represents the inner half of the amniotic fold and is composed of inner ectoderm and outer somatic mesoderm.
- ✓ The chorion represent the outer half of the amniotic folds and consists of **somatic mesoderm** on inner side and **ectoderm** on outer side.
- ✓ The formation of chorion is completed at the end of second week.
- ✓ The sero-amniotic cavity lying between the amnion and chorion constitutes **extra-embryonic coelom**.
- ✓ It retains connection with the intra-embryonic coelom through yolk stalk region until relatively late development.



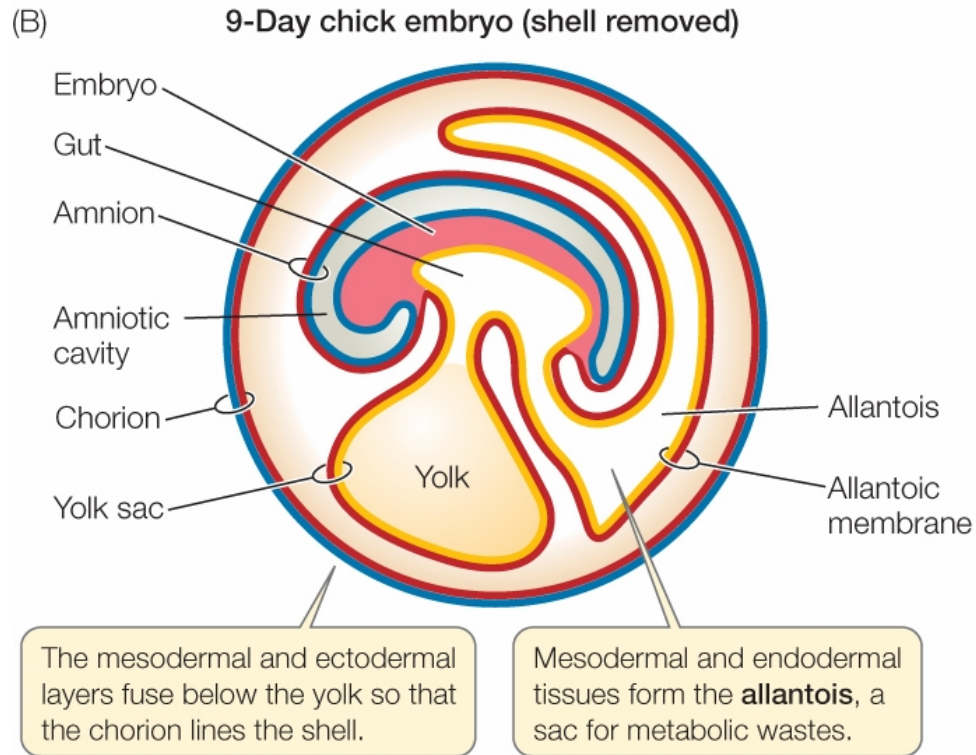
Fig; THE AMNION AND CHORION

FUNCTIONS OF AMNION AND CHORION

- Both amnion and amniotic fluid protect the developing embryo from desiccation and keep the embryo moist.
- These also prevent against shocks caused by physical forces by equalizing the pressure against the embryo.
- Adhesion of the embryo is prevented by allowing the free movement of the embryo and rhythmic movement of the amnion.

4. THE ALLANTOIS

- ✓ The allantois differs from the amnion and serosa in that it develops from the intra-embryonic part.
- ✓ The allantois begins its development as a ventral diverticulum from the hind gut in the 72 hrs. old chick.
- ✓ As a result of its rapid growth it invades the extra-embryonic coelom.
- ✓ It consists of **splanchnic mesoderm** on outside and endoderm on inner side.
- ✓ Its proximal part is called **allantoic stalk** while its distal part is termed **allantoic vesicle** which lies in the space between the yolk sac, the amnion and the serosa.
- ✓ It grows rapidly, replaces the extra-embryonic coelom gradually and fuses with the chorion.



FUNCTIONS OF ALLANTOIS

- It is partly excretory in function as it accumulates excretory wastes such as uric acid and rates.
- It also serves as a respiratory surface by supplying oxygen to the embryo.
- It helps in absorption of huge quantity of albumen.
- As allantoic circulation is in contact of egg shell via **chorion**, certain part of calcium is absorbed from the egg shell and it is utilized by the embryo for the formation of bones.
- The egg shell becomes weak due to loss of calcium. This facilitates hatching.
