EXTRA-EMBRYONIC MEMBRANES IN CHICK EMBRYO

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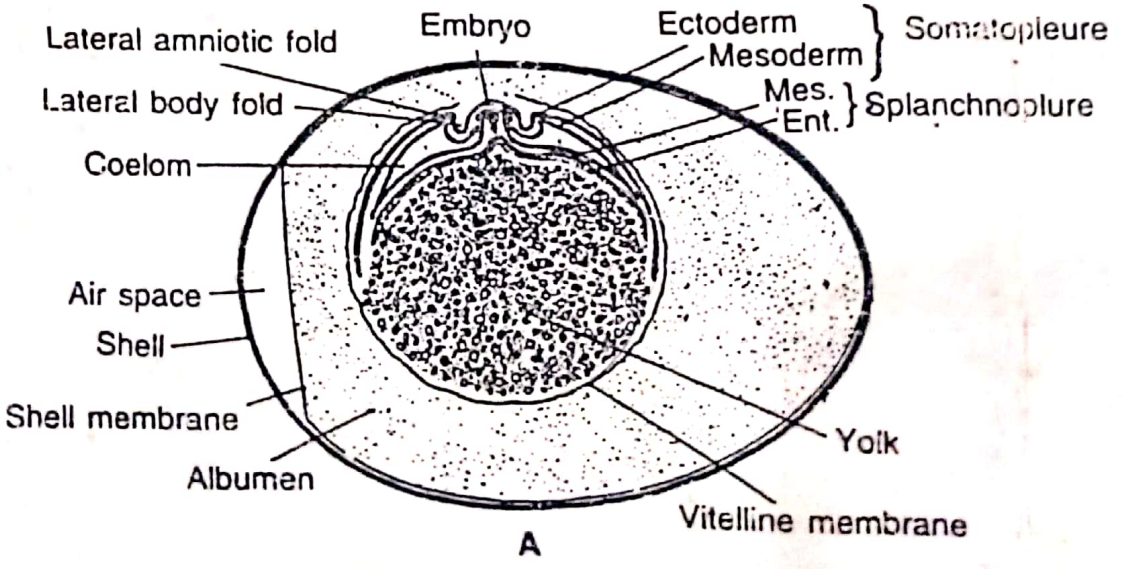
8.1. The blastoderm of chick embryo is the only embryonic part. The other parts are extra-embryonic. The four types of membranes that arise from the extra-embryonic region of the embryo are yolk sac, amnion, allantois and chorion. These membranes protect the embryo and help in nutrition, respiration, and excretion. The amnion and chorion are ectomesodermal (formed by somatopleure), whereas the yolk sac and allantois develop from extra embryonic endoderm and splanchinc mesoderm (splanchnopleure), hence may be called meso-endodermal.

(i) The yolk sac

This is the first extra embryonic membrane to appear in the embryo. The splanchnopleure does not close the gut from the ventral side but grows over the yolk surface finally enclosing the entire yolk mass. Thus the yolk mass temporarily serves as the ventral floor of the gut. The part of the gut which remains accessible to the yolk is the midgut. With the increase of the fore-and hindguts, the midgut is diminished but it maintains its connection with the underlying yolk by means of a yolk duct or yolk stalk.

With the constriction of the yolk stalk, vitelline arteries and veins are seen to run parallel and traverse the yolk stalk. The vascular network developed in the splanchnopleure of the yolk covers the yolk mass. Endodermal cells lining the yolk sac secrete digestive enzymes which hydrolyze the yolk. The digested yolk is then absorbed by the blood capillaries and transported to the



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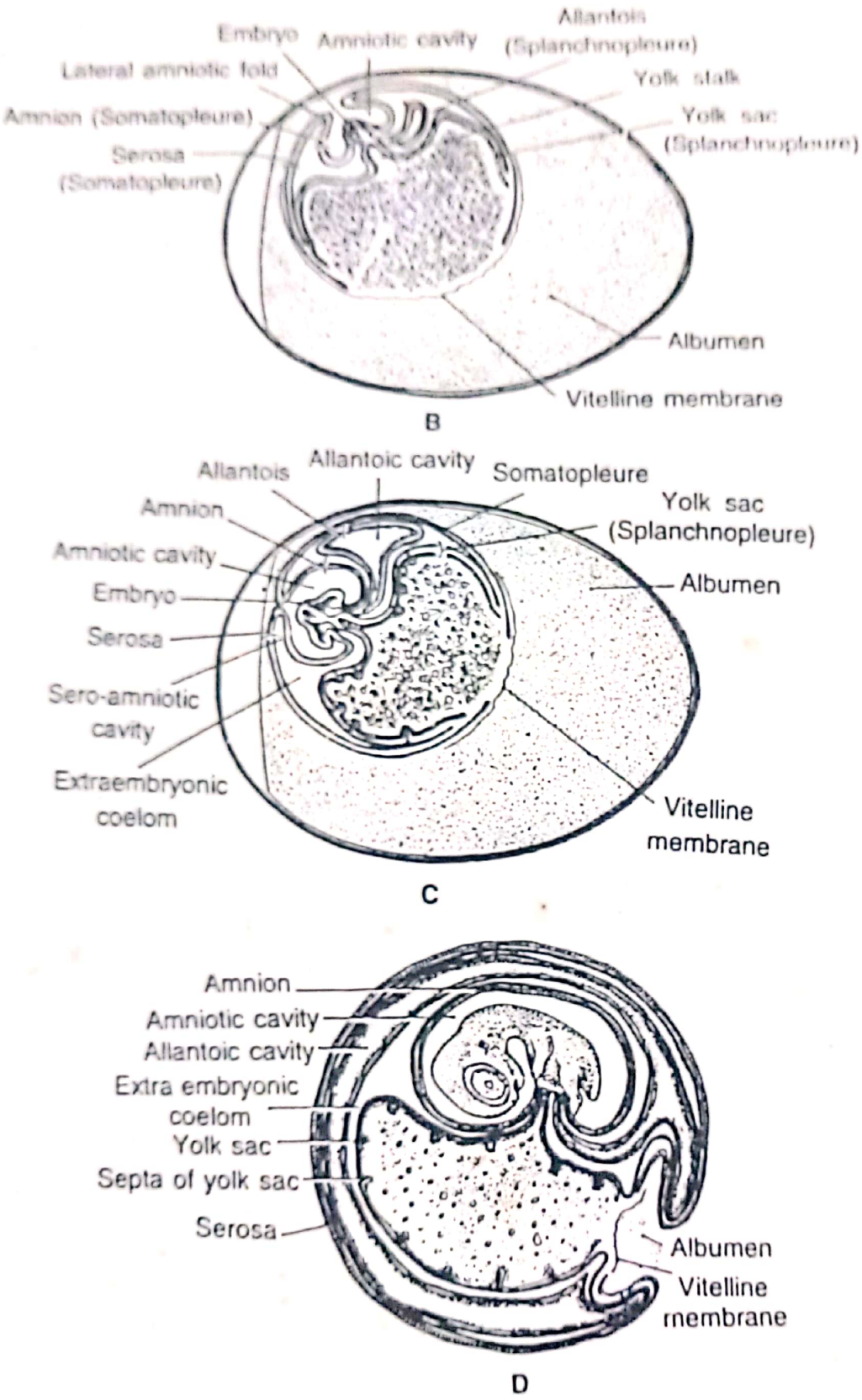

Fig. 8.1. A—D showing different stages of the development of extra-embryonic membranes in the chick

embryo. In older embryo, the epithelium of the yolk develops folding over the yolk mass to increase the surface area for absorption of the digested yolk. Toward the end of incubation the remaining substance of the yolk sac is

absorbed into the belly cavity of the embryo.

(ii) Formation of amnion and chorion

The amnion and chorion (serosa) are the two extra embryonic membranes which develop together. Both the membranes develop from the somatopleure. At about 30 hours of incubation, the head of the embryo bends into the yolk to some extent and the somatopleure in front of the head is thrown into a fold as the head fold. The margin of the head fold is somewhat crescentic and its concave side lies towards the head of the embryo. This head fold grows further into the amniotic fold. The movement of the amniotic fold caudal end covers the head of the embryo. The tail fold of the amnion also grows towards the anterior side of the embryo. The extension of these two folds covers the embryo like a cap. The growth of the tail fold takes place around the third day of incubation. At the point where the two folds meet, they become fused in a scar-like thickening, known as the **amniotic raphe.** The amniotic folds, in a way, involve doubling the somatopleure on itself. Only the inner layer of the somatopleure forms the amniotic cavity. The outer layer of somatopleure forms the chorion. The cavity between the chorion and the amnion is called extra-embryonic coelom. But it maintains its connection with the intra-embryonic coelom until the late stage of the development.

The rapid growth of chorion over the yolk sac can be observed as it encircles the yolk sac. The albumen sac is also surrounded by the folds of chorion. Eventually the chorion encompasses the embryo as well as all other extra-embryonic membranes.

(iii) Formation of allantois

Unlike amnion and chorion, the allantois arises from the body of the embryo. The proximal part of the allantois remains intra-embryonic throughout development. The distal part of allantois grows out and curves upward so as to extend into the space between the amnion and chorion.

The allantois makes its appearance after 72 hours of incubation. It arises as an ouptushing from the ventral wall of the hind gut. The walls of the allantois are, therefore, composed of splanchnopleure.

During the fourth day of incubation, the allantois grows out into the extra-embryonic coelom. The distal portion of the allantois is saclike but the proximal part is narrow and may be called the allantoic stalk. As the fluid (allantoic fluid) accumulates in the distal allantois, it gradually becomes balloon-like. There is a rapid growth of allantois between 4th and 10th day of incubation. The allantois extends further and flattens in the sero-amniotic cavity and finally encompasses the embryo as well as the yolk sac. In the process of expansion of the allantois, its outer wall fuses with the mesodermal layer of chorion. The mesodermal layer of chorion is the somatic layer and that of allantios is the splanchnic layer. When these two mesodermal layers

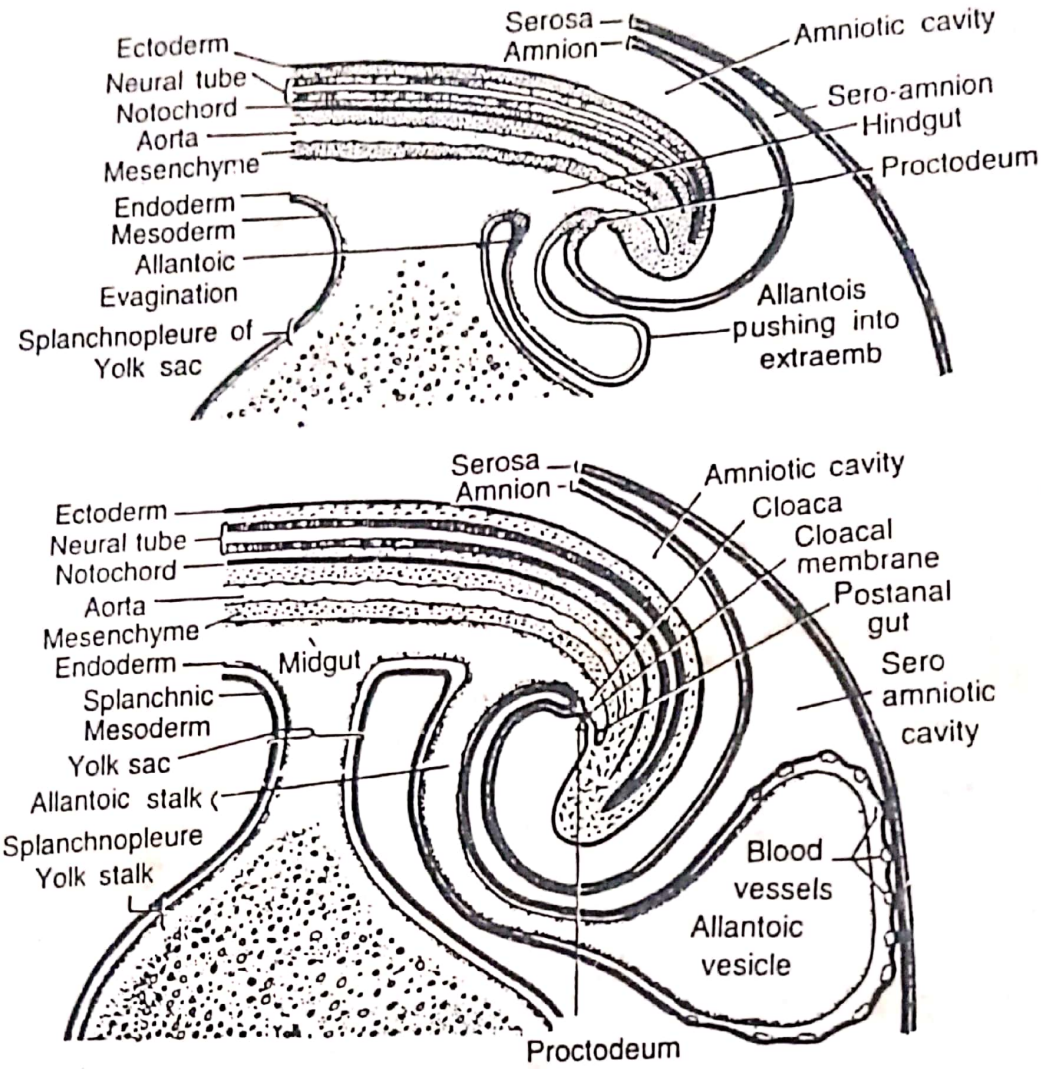

Fig. 8.2. Schematic longitudinal-section diagrams of the caudal parts of chick embryos to show the formation of the allantois. (A) at about 3 days; (B) at 4 days.

fuse, this double layer acquires rich vascular network which is connected with the embryonic circulation by the allantoic arteries and veins. The allantois, thus helps, in the exchange of gases through the highly vascular chorio-allantoic membrane. The allantois also serves to store urea and later on uric acid, as these are formed during protein metabolism of the developing embryo. Thus, the allantois wards off the embryo from the undesirable effects of the metabolic wastes by absorbing and retaining them. At the time of hatching, the allantoic stalk is broken and the distal portion of the allantois shrivels up the remains adhered to the broken shell.

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