

## Extra-embryonic membranes in Chick

In reptiles, birds and mammals, embryonic development took a new evolutionary direction-the amniote egg. This remarkable adaptation allowed development to take place on dry land. This evolutionary adaptation is so significant that reptiles, birds, and mammals are grouped together as the amniote vertebrates, or **amniotes**.

To cope with the challenges of terrestrial development, the amniote embryo produces four sets of extraembryonic membranes to mediate between it and the environment. The evolution of placenta and internal development displaced the hard-shelled egg in the mammals, but the basic pattern of extraembryonic membranes remains the same.

### The amnion and chorion:

The first problem of a land-dwelling egg faces is desiccation. Embryonic cells would quickly dry out outside an aqueous environment. Such an environment is supplied by the **amnion**. The cells of this membrane secrete **amniotic fluid**; thus, embryogenesis still occur in water.

The 2<sup>nd</sup> problem of a terrestrial egg is gas exchange. This exchange is provided for by the **chorion**, the outer most extraembryonic membrane. In birds and reptiles this membrane adheres to the shell, allowing the exchange of gases between the egg and the environment. In mammals the chorion has developed into the placenta, which has evolved endocrine, immune, and nutritive functions in addition to those of respiration.

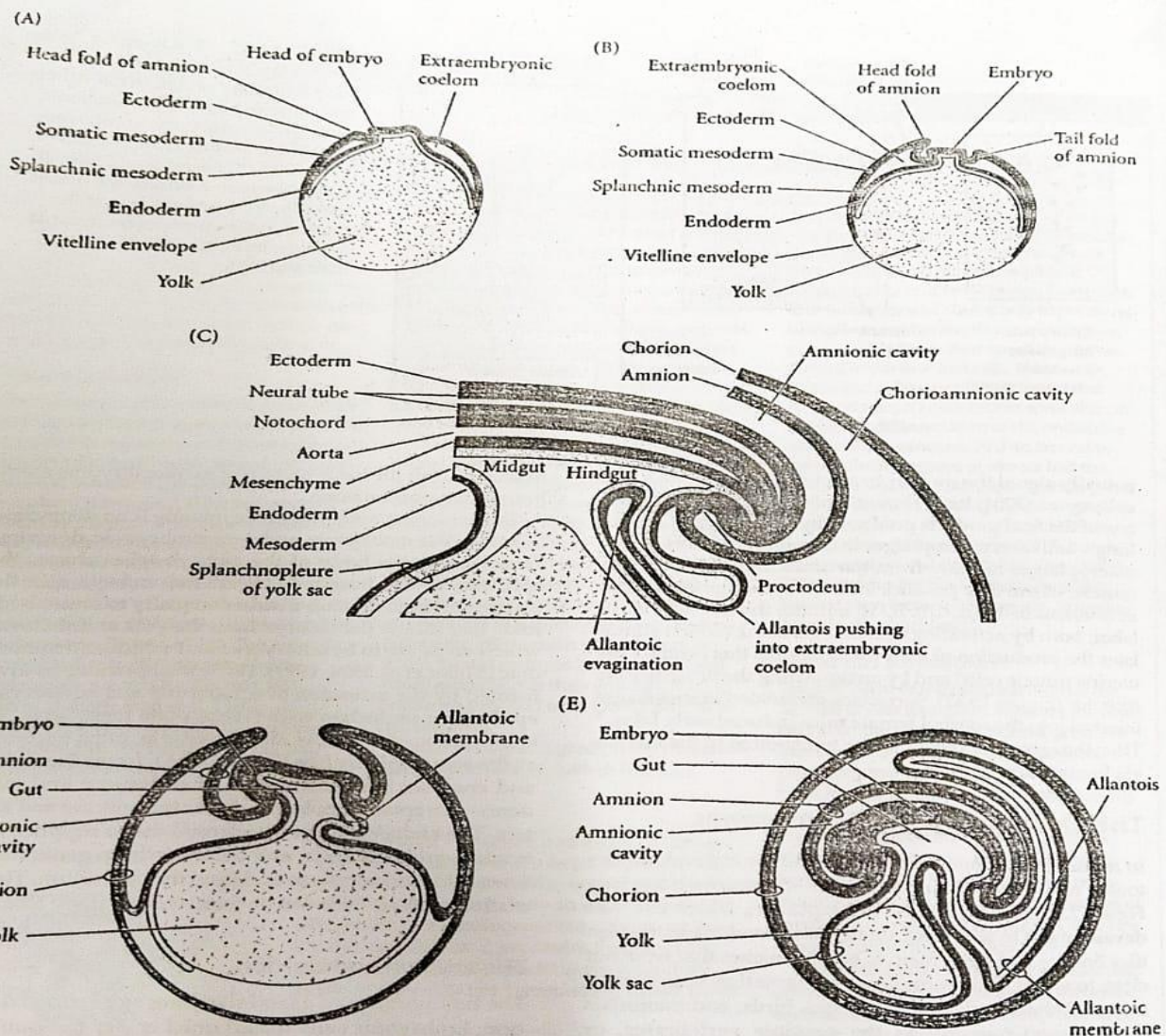
### The allantois and yolk sac:

The third problem for a terrestrial egg is waste disposal. The **allantois** stores urinary wastes and also helps mediate gas exchange. In reptiles and birds, the allantois becomes a large sac, as there is no other way to keep the toxic by-products of metabolism away from the developing embryo. In some amniote species, such as chickens the mesodermal layer of the allantoic membrane reaches and fuses with the mesodermal layer of the chorion to create the **chorioallantoic membrane**. This extremely vascular envelope is crucial for chick development and is responsible for transporting calcium from the eggshell into the embryo for bone production (Tuan 1987). In mammals, the size of the allantois depends on how well nitrogenous wastes can be removed by the chorionic placenta. In humans (in which nitrogenous wastes are efficiently removed via the maternal circulation) the allantois is a vestigial sac.

Finally, the land-dwelling egg must solve the problem of nutrition. The **yolk sac** is the first extraembryonic membrane to be formed, as it mediates nutrition in

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developing birds and reptiles. It is derived from splanchnopleural cells that grow over the yolk to enclose it. The yolk sac is connected to the midgut by an open tube, the yolk duct so that the walls of the yolk sac and the walls of the gut are continuous. The blood vessels within the mesoderm of the splanchnopleure transport nutrients from the yolk into the body, for yolk is not taken directly into the body through the yolk duct. Rather endodermal cells digest the protein in the yolk into soluble amino acids that can then be passed on to the blood vessels within the yolk sac. Other nutrients including vitamins, ions, and fatty acids, are stored in the yolk sac and transported by the yolk sac blood vessels into the embryonic circulation. In these ways, the four extraembryonic membranes enable the amniote embryo to develop on land.



**FIGURE 15.33** Schematic drawings of the extraembryonic membranes of the chick. The embryo is cut longitudinally, and the albumen and shell coatings are not shown. (A) A 2-day embryo. (B) A 3-day embryo. (C) Detailed schematic diagram of the caudal (hind) region of the chick embryo, showing the formation of the allantois. (D) A 5-day embryo. (E) A 9-day embryo. (After Carlson 1981.)

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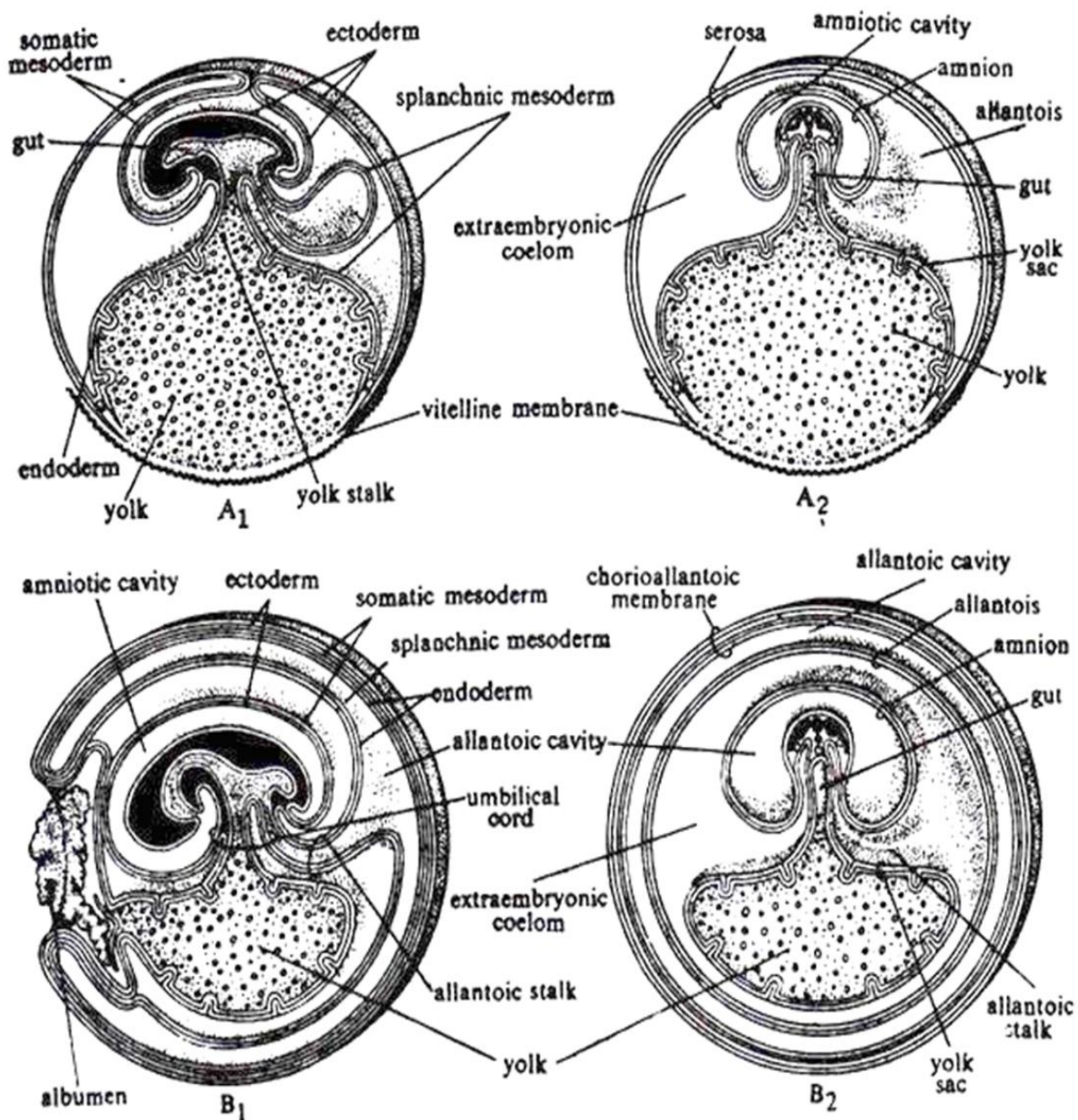


Fig. . Formation of extraembryonic membranes in chick embryo. A<sub>1</sub> and A<sub>2</sub> showing the diagrammatic longitudinal and transverse sections respectively of the chick embryo at an early stage of development. B<sub>1</sub> and B<sub>2</sub> showing the longitudinal and transverse sections respectively at a late stage of development (after Huettner).

[For further reference pls follow the book 'General Zoology' Vol-1:Chaki,Kundu ,Sarkar]