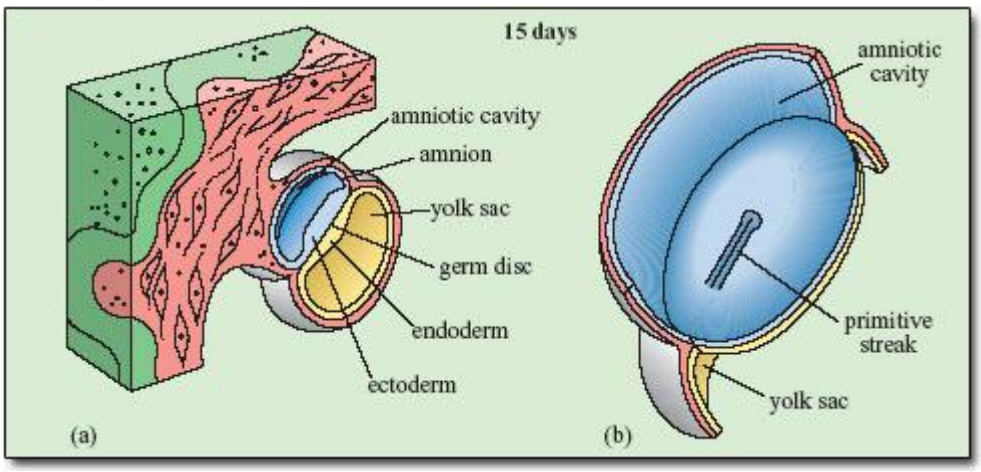
Growth of the Embryonic Disc

The embryonic disc, initially flat and almost round, gradually becomes elongated, with a broad cephalic and a narrow caudal end. Expansion of the embryonic disc occurs mainly in the cephalic region; the region of the primitive streak remains more or less the same size.

Growth and elongation of the cephalic part of the disc are caused by a continuous migration of cells from the primitive streak region in a cephalic direction.

Invagination of surface cells in the primitive streak and their subsequent migration forward and laterally continues until the end of the fourth week. At that stage, the primitive streak shows regressive changes, rapidly shrinks, and soon disappears. That the primitive streak at the caudal end of the disc continues to supply new cells until the end of the fourth week has an important bearing on development of the embryo. In the cephalic part, germ layers begin their specific differentiation by the middle of the third week, whereas in the caudal part, differentiation begins by the end of the fourth week. Thus gastrulation, or formation of the germ layers, continues in caudal segments while cranial structures are differentiating, causing the embryo to develop cephalo-caudally.



Further Development of the Trophoblast

By the beginning of the third week, the trophoblast is characterized by **primary villi** that consist of a cytotrophoblastic core covered by a syncytial layer. During further development, mesodermal cells penetrate the core of primary villi and grow toward the decidua. The newly formed structure is known as a **secondary villus.**

By the end of the third week, mesodermal cells in the core of the villus begin to differentiate into blood cells and small blood vessels, forming the villous capillary system. The villus is now known as a **tertiary villus** or **definitive placental villus.** Capillaries in tertiary villi make contact with capillaries developing in mesoderm of the chorionic

plate and in the connecting stalk. These vessels, in turn, establish contact with the intraembryonic circulatory system, connecting the placenta and the embryo. Hence, when the heart begins to beat in the fourth week of development, the villous system is ready to supply the embryo proper with essential nutrients and oxygen.

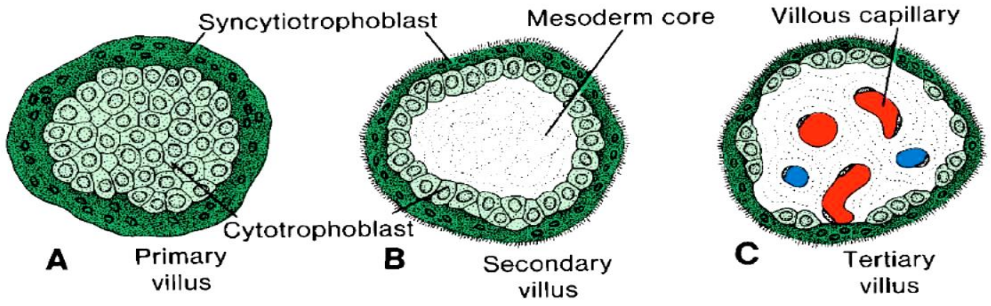


Figure 4.15 Development of a villus. **A.** Transverse section of a primary villus showing a core of cytotrophoblastic cells covered by a layer of syncytium. **B.** Transverse section of a secondary villus with a core of mesoderm covered by a single layer of cytotrophoblastic cells, which in turn is covered by syncytium. **C.** Mesoderm of the villus showing a number of capillaries and venules.

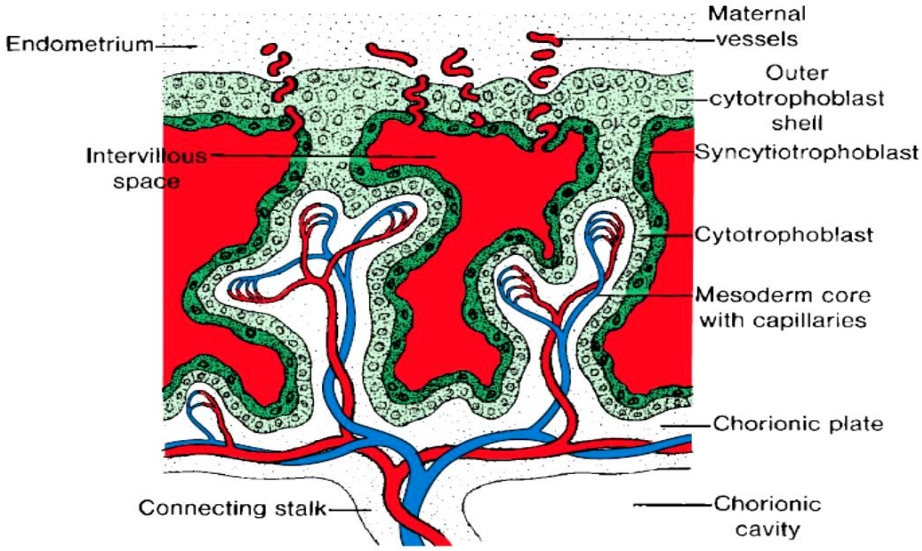


Figure 4.16 Longitudinal section through a villus at the end of the third week of development. Maternal vessels penetrate the cytotrophoblastic shell to enter intervillous spaces, which surround the villi. Capillaries in the villi are in contact with vessels in the chorionic plate and in the connecting stalk, which in turn are connected to intraembryonic vessels.

Meanwhile, cytotrophoblastic cells in the villi penetrate progressively into the overlying syncytium until they reach the maternal endometrium. Here they establish contact with similar extensions of neighboring villous stems, forming a thin **outer cytotrophoblast shell**. This shell gradually surrounds the trophoblast entirely and attaches the chorionic sac firmly to the maternal endometrial tissue. Villi that extend from the **chorionic plate** to the **decidua basalis (decidual plate:** the part of the endometrium where the placenta will form) are called **stem** or **anchoring villi.** Those that branch from the sides of stem villi are **free (terminal) villi,** through which exchange of nutrients and other factors will occur.

The chorionic cavity, meanwhile, becomes larger, and by the 19th or 20th day, the embryo is attached to its trophoblastic shell by a narrow **connecting stalk**. The connecting stalk later develops into the **umbilical cord,** which forms the connection between placenta and embryo.

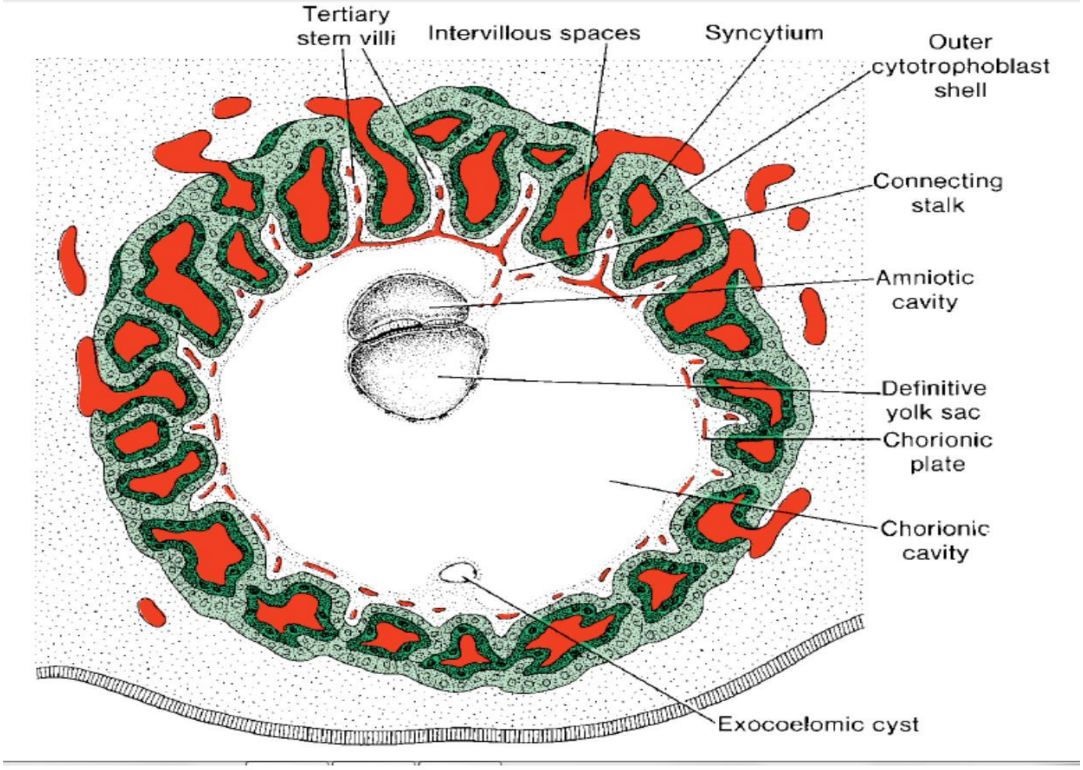


Figure 4.17 Presomite embryo and the trophoblast at the end of the third week. Tertiary and secondary stem villi give the trophoblast a characteristic radial appearance. Intervillous spaces, which are found throughout the trophoblast, are lined with syncytium. Cytotrophoblastic cells surround the trophoblast entirely and are in direct contact with the endometrium. The embryo is suspended in the chorionic cavity by means of the connecting stalk.