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1. Discuss the second week of development.

The events that take place during the second week of Embryonic development include:

- a. Completion of implantation of the Blastocyst.
- b. Formation of the Bilaminar embryonic disc.
- c. Formation of Extraembryonic structures (amniotic cavity, amnion, umbilical vesicle, connecting stalk and Chorionic sac).

Day 8: On the 8thday of development, the Blastocyst is slowly embedded in the endometrium. The *Syncytiotrophoblast* continues its invasion of the Endometrium, thereby eroding endometrial blood vessels and endometrial glands. More cells in the *Cytotrophoblast* divide and migrate into the *Syncytiotrophoblast*, where they fuse and lose their individual cell membranes.

Cells of the inner cell mass or Embryoblast also differentiate into 2 layers:

- 1. The Hypoblast layer: Its made up of small cuboidal cells, and it is nearer to the Blastocyst cavity.
- 2. The Epiblast layer: It is made up of high columnar cells, and is nearer to the Amniotic cavity.

The Hypoblast and Epiblast layers together form a flat ovoid-shaped disc, called *the Bilaminar embryonic* disc. At the same time, a small cavity appears within the Epiblast which enlarges to form the Amniotic cavity.

Epiblast cells near the Cytotrophoblast are called *Amnioblasts*. Amnioblasts together with the rest of the Epiblast, line the Amniotic cavity. The Endometrium adjacent to the implantation site is swollen and highly vascular.

Day 9: The Blastocyst is more deeply embedded in the Endometrium, the penetration defect in the surface epithelium is closed by a Coagulum called *fibrin*. Vacuoles appear at the region of the *Trophoblast* and they fuse to form Lager Lacunae.

This phase of trophoblast development is known as the Lacunar stage.

The cells of the Hypoblast near to Cytotrophoblast form a thin membrane called the Heuser's membrane. This membrane lines the inner surface of the cytotrophoblast. The Exocoelomic (Heuser's) membrane together with the hypoblast forms the lining of the Exocoelomic cavity/primitive yolk/ primary umbilical vesicle.

Day 11-12: The Blastocyst is completely embedded in the Endometrium, and the surface epithelium almost entirely covers the original defect in the uterine wall. The blastocyst now produces a slight protrusion into the *lumen* of the Uterus.

Cells of the Syncytiotrophoblast penetrate deeper into the tissue and erode the endothelial lining of the endometrial capillaries. These ruptured endometrial capillaries are called *Sinusoids*. The lacunae then begin to communicate with the Sinusoids, and maternal blood enters the Lacunar system.

The communication of the eroded endometrial capillaries with the *lacunae*, establishes the primordial Utero-placental circulation. When maternal blood flows into the *lacunae*, oxygen and nutrients are available to the embryo.

A new population of cells appears between the inner surface of the Cytotrophoblast, and the outer surface of the Exocoelomic cavity. These cells are derived from yolk sac cells, and form a fine, loose connective tissue called the *Extraembryonic* mesoderm. Soon, large cavities develop in the extraembryonic mesoderm, and when these become confluent, they form a new space known as the extraembryonic cavity, or chorionic cavity or Extraembryonic coelom.

This space surrounds the primitive yolk sac and amniotic cavity, except where the germ disc is connected to the Trophoblast by the connecting stalk (which develops into the umbilical cord). The *extraembryonic mesoderm* lining the Cytotrophoblast and amnion is called the *extraembryonic somatic mesoderm*.

The Extraembryonic somatic mesoderm also forms the connecting stalk. The lining covering the yolk sac is known as the *Extraembryonic Splanchnic mesoderm*. As the *conceptus* implants, the endometrial connective tissue cells undergo a transformation, called Decidual Reaction

During this transformation, the cells of the endometrium swell because of the accumulation of glycogen and lipid in their cytoplasm, and they are known as Decidual cells. The primary function of the Decidual reaction is to provide nutrition for the early embryo, and an immunologically privileged site for the *conceptus*.

Day 13: The surface defect in the Endometrium has been completely covered by the surface epithelium. Occasional bleeding occurs at the implantation site as a result of increased blood flow into the Lacunar spaces. Cells of the Cytotrophoblast proliferate locally, and penetrate into the Syncytiotrophoblast, forming cellular columns surrounded by **syncytium**. Cellular columns with the syncytial covering are known as *primary villi*. The primary yolk sac becomes reduced in size and is known as the secondary yolk sac.

This new cavity is known as the Secondary yolk sac or Definitive yolk sac or the Secondary umbilical vesicle. In humans, the yolk sac contains no yolk but is important for the transfer of nutrients between the foetus and mother. This yolk sac is much smaller than the original exocoelomic cavity or primitive yolk sac. During its formation, large portions of the exocoelomic cavity are pinched off to form *Exocoelomic cysts.*

Exocoelomic cysts are often found in the Extraembryonic cavity or Chorionic cavity. Meanwhile, the extraembryonic coelom expands and forms a large cavity called the Chorionic cavity. The extraembryonic mesoderm lining the inside of the Cytotrophoblast is then known as the Chorionic plate. The only place where Extraembryonic mesoderm traverses the chorionic cavity is in the Connecting Stalk. With development of blood vessels, the Connecting stalk becomes the Umbilical cord.