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18/MHS01/046

MEDICINE AND SURGERY

200L

EMBRYOLOGY

1. Discuss the second week of development

Second week of human development involves the development of a developing human between day 8-day 14. The main events that occur in second week are;

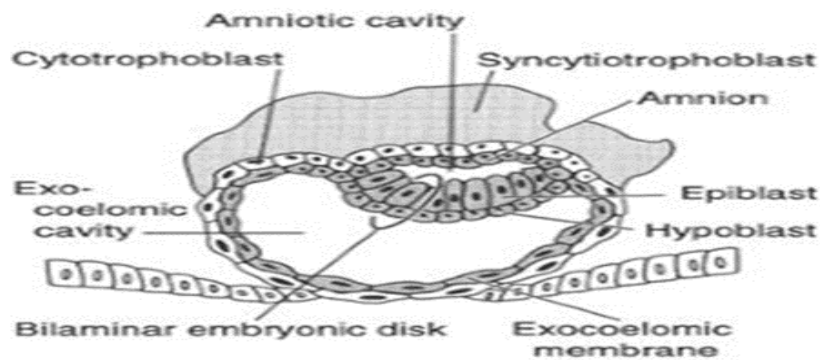
- ❖ Completion of implantation of blastocyst
- ❖ Formation of bilaminar embryonic disk (epiblast and hypoblast)
- ❖ Formation of extraembryonic structures (amniotic cavity, chorionic sac, umbilical vesicle (yolk sac), connecting stalk, amnion)

**DAY 8**

The blastocyst is partially embedded in the endometrium. The region of the syncytiotrophoblast will continue to invade the endometrium, eroding the endometrial glands and blood vessels. The cells of cytotrophoblast will start to divide and migrate to the region of syncytiotrophoblast where they fuse and lose their individual cell membranes. Cells of the inner cell mass or embryoblast also differentiate into 2 layers:

- The hypoblast which is made of cuboidal cells and is nearer to the blastocyst cavity
- The epiblast which is made of 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 (germ) disc. A small cavity appears within the epiblast which enlarges to form the amniotic cavity. Epiblast cells adjacent to the cytotrophoblast are called amnioblasts (cells of amnion). Amnioblasts together with the rest of the epiblast line the amniotic cavity. The endometrium adjacent to the implantation site is edematous and highly vascularized.

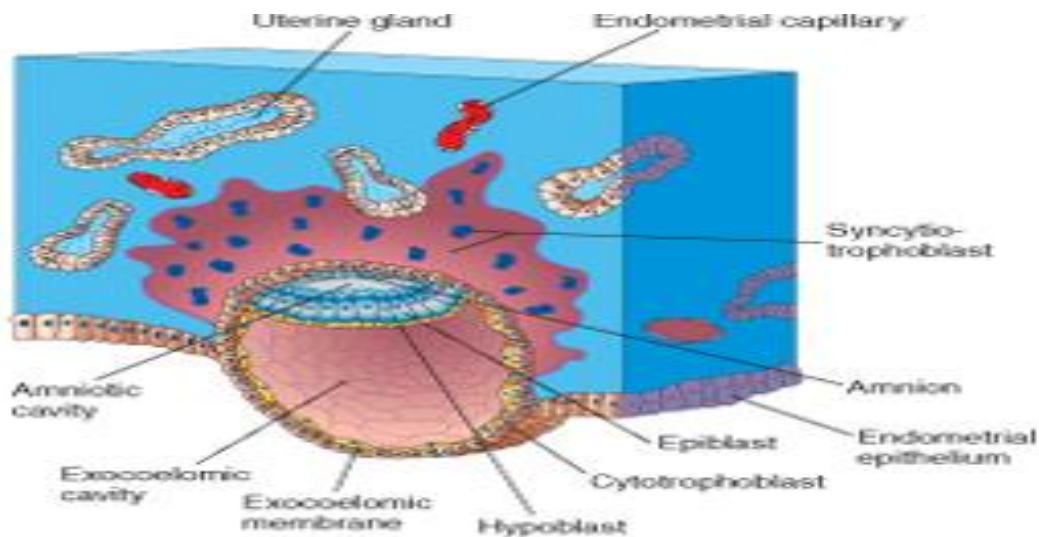


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## DAY 9

The blastocyst is deeply embedded in the endometrium. The syncytiotrophoblast continuously erodes the endometrium, its glands and blood vessels. The cytotrophoblast continues to divide and migrate to the region of the syncytiotrophoblast. The penetration defect in the surface epithelium is closed by a fibrin coagulum. Cells of hypoblast adjacent to the cytotrophoblast form a thin membrane called exocoelomic membrane/ Heuser's membrane. This lines the inner cells of cytotrophoblast.

The exocoelomic membrane together with the hypoblast, line the exocoelomic cavity/primary (primitive) yolk sac/primary umbilical vesicle. Vacuoles appear in the region of syncytiotrophoblast and with time, they develop to form lacunae and is called trophoblastic lacunae. This phase of trophoblast development is called the lacunar stage.

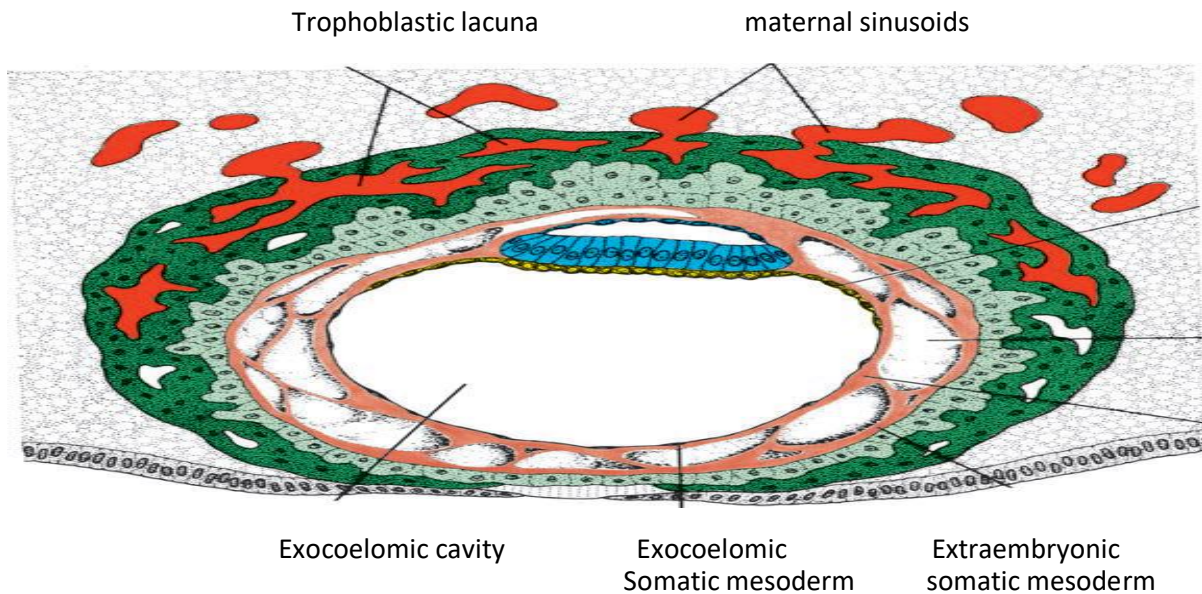


## DAY 11-12

The blastocyst is completely embedded in the endometrium. The surface epithelium now covers the original defect in the uterine wall. The blastocyst produces a slight protrusion into the lumen of the

uterus. The syncytiotrophoblast further erodes the endothelial lining of the endometrium. As it erodes the endometrium deeper, it ruptures the endometrial capillaries and blood vessels. These ruptured capillaries are called sinusoids. The ruptured sinusoids communicate with trophoblastic lacunae which allow maternal blood to enter the lacunar system. This establishes the primordial uteroplacental circulation. This helps to transport oxygen and nutrients to the developing embryo from the mother as the sinusoids carry oxygen and nutrients.

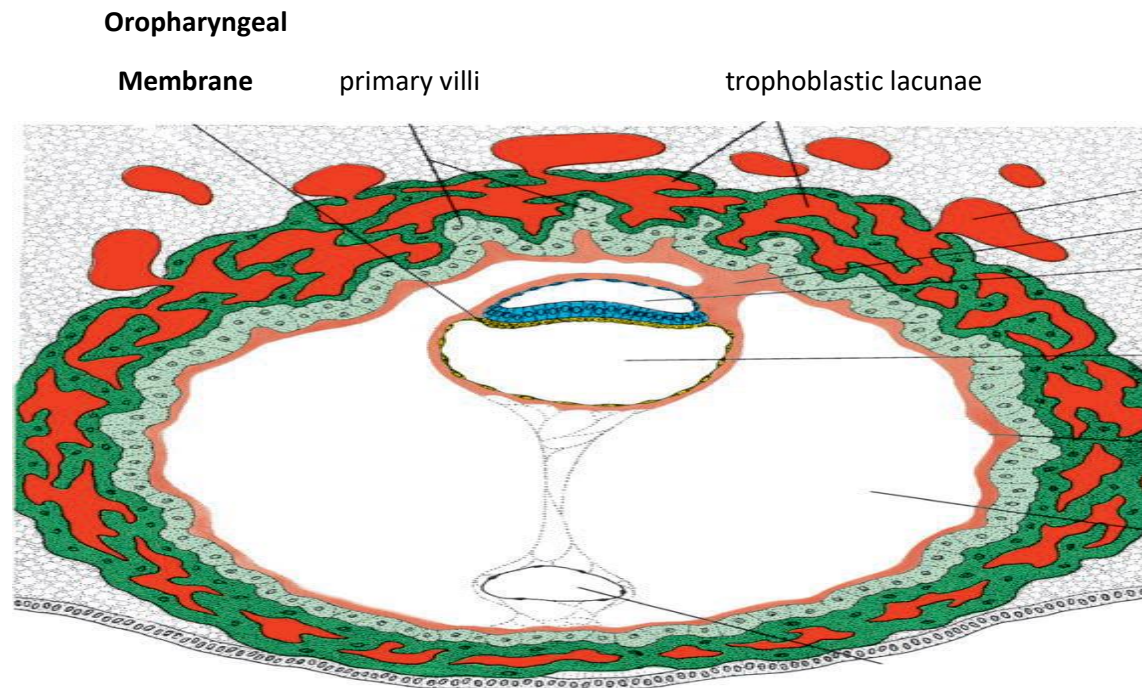
A space of mesoderm develops between the region of the cytotrophoblast and exocoelomic membrane and between the region of cytotrophoblast and amnioblast except at a point called connecting stalk. This mesoderm of loose connective origin is called extraembryonic mesoderm. Large cavities begin to develop at this region and is called extraembryonic cavity/ chorionic cavity/ extraembryonic coelom. These cavities divide the mesoderm into two parts. This space surrounds the primitive yolk sac and amniotic cavity, except where the germ disc is connected to the trophoblast by the connecting stalk. The extraembryonic mesoderm lining the cytotrophoblast and amnion is called the extraembryonic somatic mesoderm. The extraembryonic mesoderm lining 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. Occasionally 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. The cytotrophoblast with the syncytial covering is

known as primary villi. These cells proliferate and gradually form a new cavity known as the secondary yolk sac or definitive yolk sac or the secondary umbilical vesicle. 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 or extraembryonic coelom. Meanwhile, the extraembryonic coelom expands and forms a large cavity, 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.



#### CLINICAL CORRELATE

- The syncytiotrophoblast produces a hormone called human chorionic gonadotropin (HCG), which enters the maternal blood via lacunae keeps the corpus luteum secreting estrogens and progesterone. This hormone maintains the normal activity of the corpus luteum in the ovary. It can be detected in maternal blood or urine as early as day 10 of pregnancy and is the basis for pregnancy tests. A plentiful amount of the hormone is produced by syncytiotrophoblast at the end of second week to give a positive pregnancy test, even though the woman is probably unaware.
- The blastocyst may implant outside the uterus. These implantations result in ectopic pregnancies. Most of the times, it occurs in the uterine tubes, most often in the ampulla and isthmus.