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DEPT: MEDICINE AND SURGERY

LEVEL: 200

COURSE CODE: ICBS- INTEGRATED CORE BASIC SCIENCES-  
ANATOMY, BIOCHEMISTRY, PHYSIOLOGY

ASSIGNMENT TITLE: DEVELOPMENT

## QUESTIONS

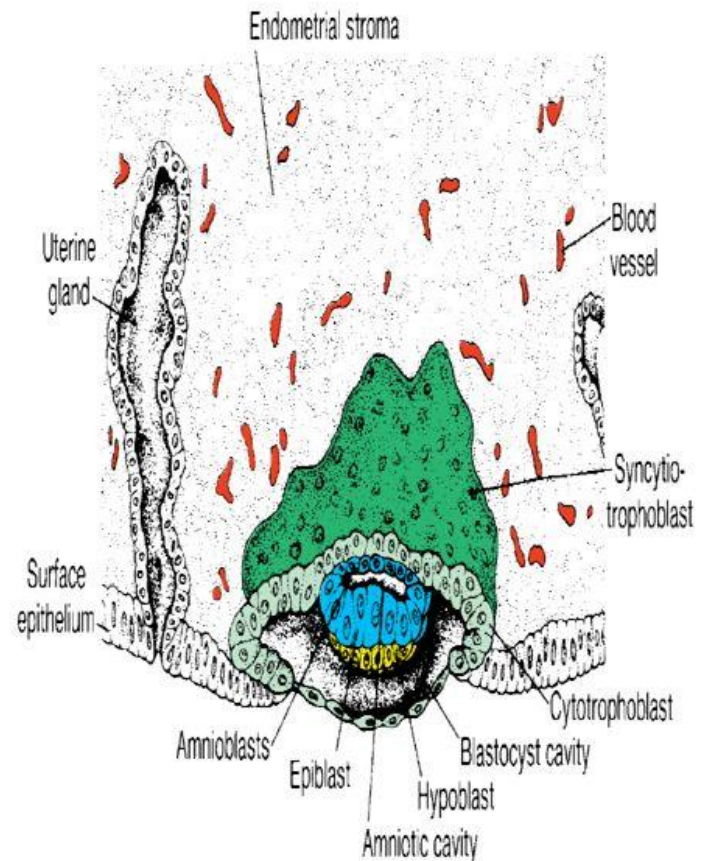
1. Discuss the second week of development.

The following events take place in the second week of embryonic development:

- Completion of implantation of the blastocyst.
- Formation of a bilaminar embryonic disc.
- Formation of extra embryonic structures.
  - **Day 8:** The blastocyst is **partially embedded** in the endometrium. The outer mass of cells of the blastocyst, the trophoblast would have differentiated into an outer layer, the *syncytiotrophoblast* and an inner layer, the *cytotrophoblast* approximately 6 days after fertilization. On day 8, The syncytiotrophoblast will continue to erode the region of the endometrium thereby destroying the blood vessels and the capillaries present while the cytotrophoblast cells will continue to divide and migrate to the region of the syncytiotrophoblast where they fuse and lose their cell membrane. The cells of the inner mass of the blastocyst, embryoblast differentiates into 2 layers: a layer of cuboidal cells adjacent to the blastocyst cavity called the *hypoblast* and a layer of columnar cells adjacent to the amniotic cavity called the *epiblast*. The two layers give rise to a flat disc called the ***bilaminar germ disc***. The cells that are adjacent to the cytotrophoblast are called ***amnioblast/amnion*** in which

# Day 8

- At the eighth day of development, the blastocyst is partially embedded in the endometrial stroma.
- In the area over the embryoblast, the trophoblast has differentiated into two layers:
  - (a) an inner layer of mononucleated cells, the **cytotrophoblast**,
  - (b) an outer multinucleated zone without distinct cell boundaries, the **syncytiotrophoblast**
- Mitotic figures are found in the cytotrophoblast but not in the syncytiotrophoblast.
- Thus, cells in the cytotrophoblast divide and migrate into the syncytiotrophoblast, where they fuse and lose their individual cell membranes.

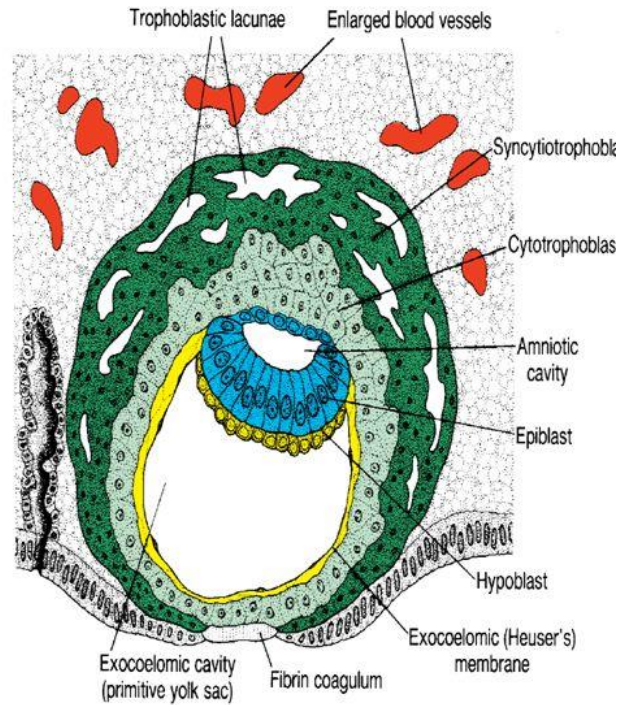


together with the rest of the epiblast surrounds a cavity which enlarges and forms the **amniotic cavity**.

- **Day 9:** The blastocyst is **more deeply** embedded in the endometrium and the penetration defect in the surface epithelium is closed by a fibrin coagulum. As development continues, vacuoles appear at the region of the syncytiotrophoblast and enlarge to become larger lacunae termed *the trophoblastic lacunae*; this phase of trophoblast development is known as the lacunar stage. Meanwhile, a thin membrane lies adjacent to the cytotrophoblast formed by the cells of the hypoblast called the *Heuser's / exocoelomic membrane*. This membrane together with the hypoblast

# Day 9

- The blastocyst is more deeply embedded in the endometrium, and the penetration defect in the surface epithelium is closed by a fibrin coagulum
- The trophoblast shows considerable progress in development, particularly at the embryonic pole, where vacuoles appear in the syncytium.
- When these vacuoles fuse, they form large lacunae, and this phase of trophoblast development is thus known as the **lacunar stage**
- At the abembryonic pole, meanwhile, flattened cells probably originating from the hypoblast form a thin membrane, the exocoelomic (Heuser's) membrane, that lines the inner surface of the cytotrophoblast
- This membrane, together with the hypoblast, forms the lining of the **exocoelomic cavity**, or **primitive yolk sac**.



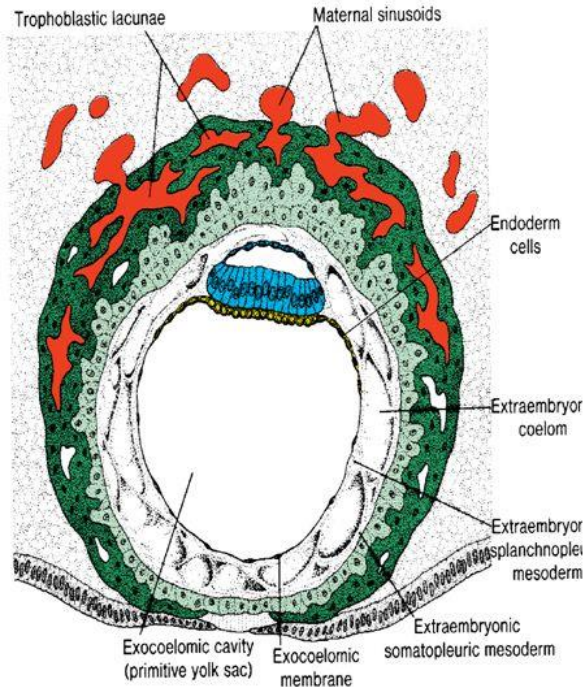
forms the lining of a cavity called the ***exocoelomic cavity/ primitive yolk sac/ primary umbilical vesicle***.

- **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. The cells of the syncytiotrophoblast continue to penetrate deeper and erode the endothelial lining of the capillaries of the endometrium. These ruptured capillaries which are now congested and dilated are called *sinusoids*. The sinusoids communicate with the trophoblastic lacunae. At this stage, transfer of nutrients, Oxygen contained in the maternal blood is possible through the lacunar system thereby establishing a ***primordial utero-placental circulation***. Meanwhile, a fine loose connective tissue termed the *extra embryonic mesoderm* derived from the yolk sac cells appears between

the region of the cytotrophoblast and the exo-coelomic membrane and also between the cytotrophoblast and the amnioblast except at a point called the connective stalk [which develops into the umbilical cord]. Soon, there is a development of cavities inside the mesoderm termed ***the extra embryonic cavity/ extra embryonic coelom/ chorionic cavity***. This cavity divides the mesoderm into two parts : The extra embryonic mesoderm lining the cytotrophoblast and the amnion called the *extra embryonic somatic mesoderm* which also forms the connecting stalk and the extra embryonic mesoderm lining the yolk sac called the *extra embryonic splanchnic mesoderm*. As the conceptus implantation occurs, the endometrial connective cells undergo transformation called the *decidua reaction* which is first confined to the area immediately surrounding the implantation site but soon occur throughout the endometrium; during this reaction, the cells of the endometrium become polyhedral and loaded with glycogen and lipids and called *decidua cells*, intercellular spaces are filled with extravasate and the tissue is edematous {swollen}. The primary function of the decidua reaction is to provide nutrition for the early embryo and an immunologically privileged site for the embryo.

## Days 11 and 12

- By the 11th to 12th day of development, the blastocyst is completely embedded in the endometrial stroma
- and the surface epithelium almost entirely covers the original defect in the uterin wall
- The blastocyst now produces a slight protrusion into the lumen of the uterus.
- The trophoblast is characterized by lacunar spaces in the syncytium that form an intercommunicating network.
- This network is particularly evident at the embryonic pole; at the abembryonic pole, the trophoblast still consists mainly of cytotrophoblastic cells



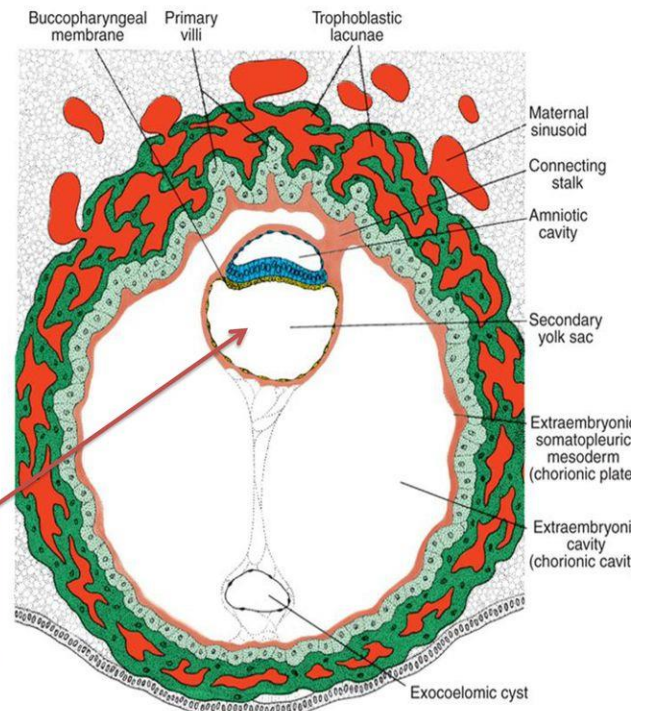
➤ **Day 13:** The surface defect in the endometrium has usually healed. Occasionally bleeding occurs at implantation site as a result of increased blood flow into the lacunar spaces. The cells of the cytotrophoblast proliferate locally and penetrate into the syncytiotrophoblast forming cellular columns [villi-like structures] surrounded by syncytium known as the *primary villi*. The connecting stalk gives rise to the future **umbilical cord**; the extra embryonic cavity enlarges to form a large cavity called the **chorionic cavity**. The primary yolk sac becomes smaller to become **secondary yolk sac/ secondary umbilical vesicle/ definitive yolk sac**. During its formation, large portions of the exocoelomic cavity are pinched off and represented as *exocoelomic cysts* and are often found in the chorionic cavity. The extra embryonic mesoderm lining the cytotrophoblast is then known as the *chorionic plate*; the only place where the extra embryonic mesoderm transverses the chorionic cavity is the connecting

stalk. With the development of blood vessels, the connecting stalk becomes the *umbilical cord*.

### Day 13

The **hypoblast** produces cells that migrate along the inside of the **exocoelomic membrane**. These cells proliferate and gradually form a new cavity within the exocoelomic cavity. This new cavity is known as

**THE  
SECONDARY  
YOLK SAC  
OR DEFINITIVE  
YOLK SAC**



### ❖ Clinical correlates

- The syncytiotrophoblast produces a hormone called the human chorionic gonadotropin [hcG] which enters the maternal blood through the lacunae and keeps the corpus luteum in the ovary secreting estrogens and progesterones during pregnancy. Enough hcG is produced by the end of the second week to give a positive pregnancy test; it can be detected as early as day 10 of pregnancy and is the basis for pregnancy tests.
- Abnormal implantation sites sometimes occur even within the uterus. Normally, the human blastocyst implants along the anterior or posterior wall of body of uterus. Occasionally, the blastocyst implants close to the internal os opening of the cervix and later in development the placenta bridges the opening and cause severe bleeding in the second part of pregnancy and delivery.
- In other cases, the implantation may take place outside the uterus resulting in an extrauterine or ectopic pregnancy. It may occur at any place in the abdominal cavity, ovary or uterine tube. However, 95-98% of ectopic implantations occur in the uterine tubes, most often the ampulla and isthmus.