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MATRIC NUMBER: 18/MHS01/026

COLLEGE: MEDICAL AND HEALTH SCIENCE

DEPARTMENT: MEDICINE AND SURGERY

COURSE: INTEGRATED CORE BASIC SCIENCES - ANATOMY, BIOCHEMISTRY & PHYSIOLOGY

COURSE CODE: ICBS

ASSIGNMENT TITLE: EMBRYOLOGY

### ANSWER TO THE ASSIGNMENT

#### 2ND WEEK OF DEVELOPMENT

The following events that take place during the second week of development include;

1. Completion of the implantation of the blastocyst
2. Formation of bilaminar embryonic disc (epiblast and hypoblast)
3. Formation of extraembryonic structures (amniotic sac, amnion, umbilical vesicle [yolk sac], connecting stalk and chorionic sac)

**NOTE:** Certain days considered during this second week of development are days 8, 9, 11 – 12, and 13.

#### DAY 8 OF DEVELOPMENT:

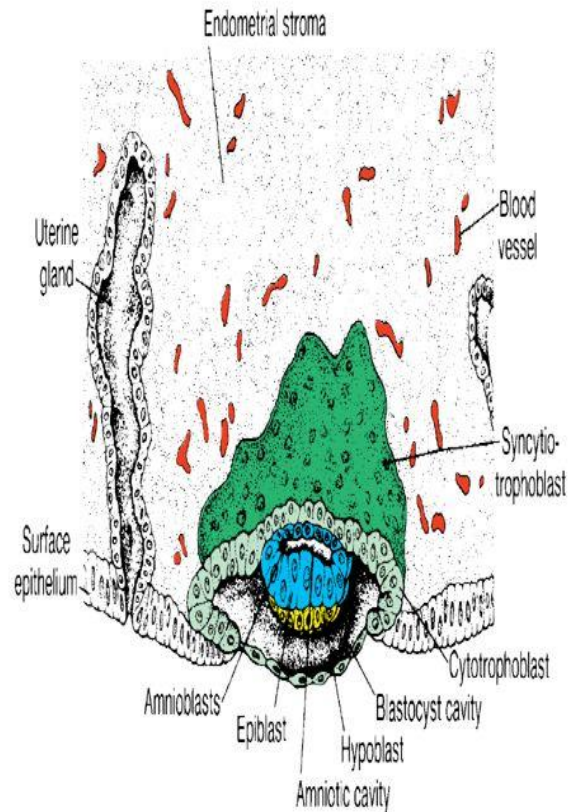
The blastocyst is slowly embedded into the endometrial wall of the uterus. In the area over the embryoblast, the trophoblast has differentiated into two layers; an inner layer of mononucleated cells, the cytotrophoblast, and an outer multinucleated zone without distinct cell boundaries, the syncytiotrophoblast. In the endometrial wall, the syncytiotrophoblast continues its invasion, resulting in its erosion of the endometrial blood vessels and glands. Cells of the cytotrophoblast still undergo its several divisions and migrate into the region of the syncytiotrophoblast, where they fuse together and lose their individual plasma membranes. Next is the differentiation of the inner cell mass or embryoblast into two respective layers namely the;

- a. layer of small cuboidal cells adjacent to the blastocyst cavity, known as the **hypoblast layer**.
- b. layer of high columnar cells adjacent to the amniotic cavity, the **epiblast layer**.

The differentiation of the embryoblast into these two layers (hypoblast and epiblast) together form a flat ovoid-shaped disc named the **bilaminar embryonic disc**. Similar to this occurrence is the appearance of a small cavity within the epiblast to form the **amniotic cavity**. Epiblastic cells adjacent to the cytotrophoblast are called **amnioblasts**. Amnioblasts together with the rest of the epiblast are seen to line the amniotic cavity and the endometrium adjacent to the site of implantation is highly vascular and edematous as well.

# 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.

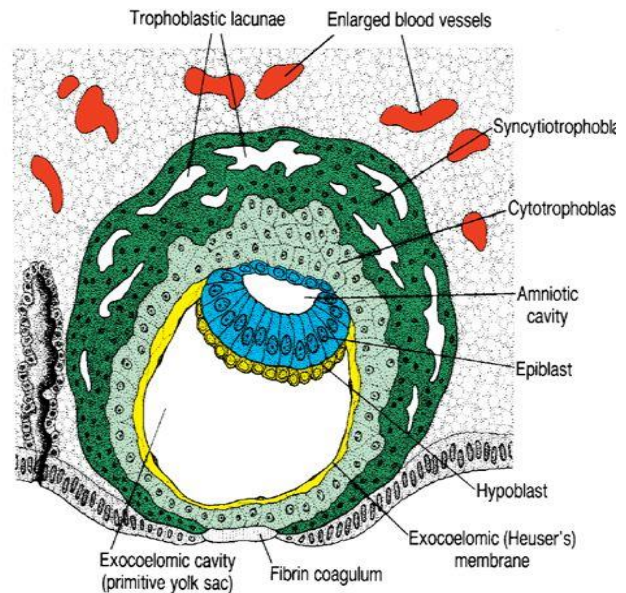


## DAY 9 OF DEVELOPMENT:

The blastocyst is more deeply embedded in the endometrium, and the penetration defect in the surface epithelium is closed by a fibrin coagulum (a blockage). The trophoblast shows considerable progress in development, vacuoles appear, fuse to form a **large lacuna** and this phase of trophoblast development is thus known as the **lacunar stage**. The hypoblastic cells adjacent to the cytotrophoblast form a thin membrane called the **exocoelomic (heuser's) membrane** which lines the inner surface of the cytotrophoblast. The exocoelomic membrane alongside the hypoblast forms the lining of the **exocoelomic cavity** or **primitive yolk sac**, or **primary umbilical vesicle**.

## 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.**



### DAY 11-12 OF DEVELOPMENT:

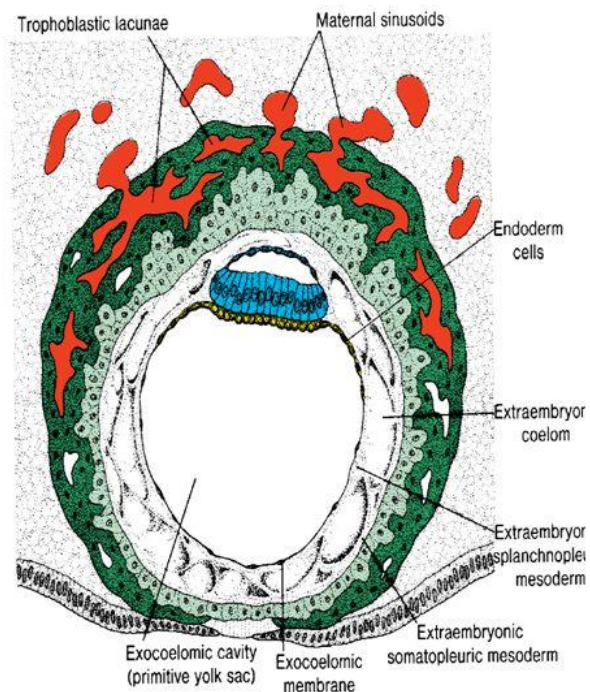
By the 11th to 12th day of development, the blastocyst is completely embedded in the endometrial stroma and the surface epithelium almost entirely covers the original defect in the uterine wall. A slight protrusion into the lumen of the uterus is made by the blastocyst and cells of the syncytiotrophoblast penetrate deeper into the tissue, eroding the endothelial lining of the endometrial capillaries. These ruptured endometrial capillaries are called **sinusoids**, with the syncytial lacunae becoming continuous with the sinusoids and maternal blood enters the lacunar system. Ruptured sinusoids communicate with the trophoblastic lacuna resulting in the blood from the mother to the child. This helps to transfer nutrients, oxygen, and blood to the embryo and a **primordial uteroplacental circulation** is established. Following this is the appearance of a new population of cells and a space of mesoderm develops between the amnioblast and the cytotrophoblast, the exocoelomic cavity and the cytotrophoblast except at the point of the connecting stalk. The space of mesoderm is made up of a fine, loose connective tissue called the **extraembryonic mesoderm**. Large cavities then begin to develop in the extraembryonic mesoderm which become confluent and form a new space, the **extraembryonic cavity, or chorionic cavity, or extraembryonic coelem**. This then divides the extraembryonic mesoderm into two parts namely;

- a. A part adjacent to the cytotrophoblast called the **extraembryonic somatic mesoderm** which also forms the connecting.
- b. A part lying adjacent to the amnioblast called the **extraembryonic splanchnic mesoderm**.

As the conceptus implants and developments occurs, the endometrial cells undergo a transformation, a **decidual reaction**. During this transformation, the cells of the endometrium swell due to the accumulation of glycogen and lipids in their cytoplasm, with the cells being referred to 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.

## 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 OF DEVELOPMENT:

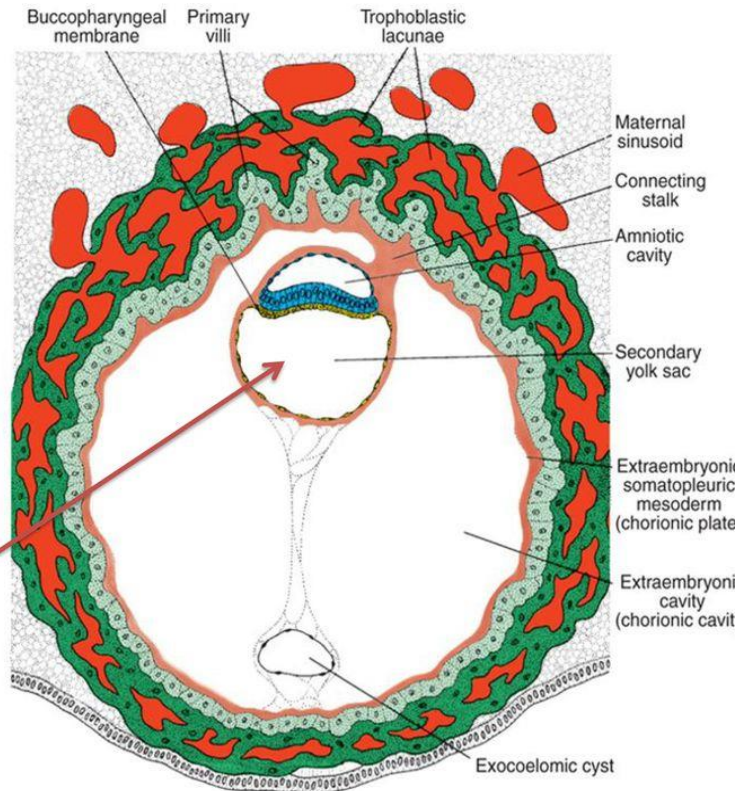
By the 13th day of development, the surface defect in the endometrium has been completely covered by the surface epithelium. Occasionally, however, bleeding occurs at the implantation site as a result of increased blood flow into the lacunar spaces. The cytotrophoblastic cells then proliferate locally to penetrate the syncytiotrophoblast forming cellular columns surrounded by syncytium, and these cellular columns with syncytial coverings are known as **primary villi**. The primary yolk sac reduces in size and known as the **secondary yolk sac** (a new cavity), also referred to as **definitive yolk sac** or **secondary umbilical yolk sac**. It is important to note that the yolk sac is smaller in size than the original exocoelomic cavity due to the fact that during its formation, large portions of the exocoelomic cavity are pinched off to form exocoelomic cysts which are found in the chorionic cavity. The yolk sac in humans contains no yolk but is essential for the transfer of nutrients between the mother and the fetus. 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 the development of blood vessels, the 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 SIGNIFICANCE:

- a. **Pregnancy Testing:** The syncytiotrophoblast produces the hormone **hCG (human chorionic gonadotropin)** that enters the maternal blood via the lacuna and sustains the corpus luteum so it secretes the hormones, estrogen and progesterone. hCG maintains the hormonal activity of the corpus luteum in the ovary during pregnancy. This hormone can be detected in the maternal blood or urine as early as **10 days of pregnancy and is the basis of pregnancy test**. Enough hCG is produced by the syncytiotrophoblast at the end of the second week in order to give a positive test, though the woman may be unaware of her being pregnant.
- b. **Extrauterine Implantation:** this is the case whereby the blastocyst implants itself outside the uterus usually resulting in the condition, **ectopic pregnancy**. 90-98% of ectopic pregnancy are common to occur at the uterine tube, especially at the **ampulla and isthmus** of the female reproductive system.