

NAME: BOROKINNI OLUWATOFUNMI DIVINE.

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DEPARTMENT: MEDICINE AND SURGERY (MBBS)

COLLEGE: MEDICINE AND HEALTH SCIENCES (MHS)

LEVEL: 200L

ASSIGNMENT: Discuss the second week of development

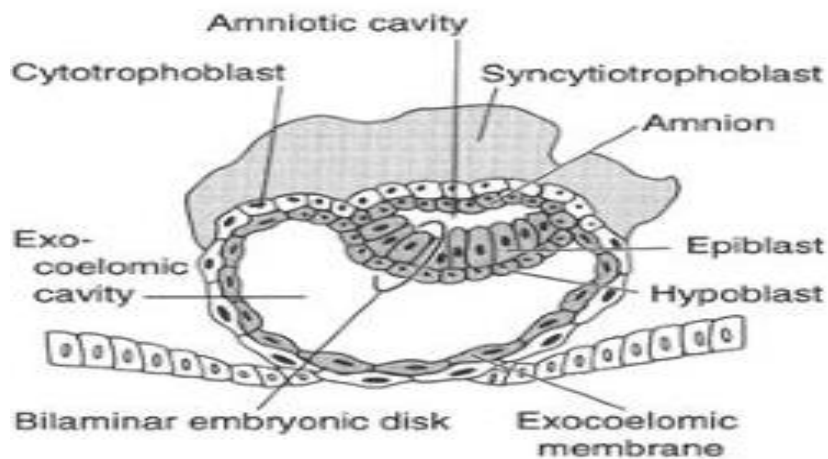
2nd week of development

The following events take place during the 2nd week of development:

- I. Completion of implantation of the blastocyst
- II. Formation of bilaminar embryonic disc(epiblast and hypoblast)
- III. Formation of extraembryonic structures(amniotic cavity, amnion, umbilical vesicle [yolk sac], connecting stalk, and chorionic sac)

Day 8

- **At** the eighth day of development, the blastocyst is partially (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:
 - I. the hypoblast layer, which is made up of small cuboidal cells, and it is adjacent(nearer) to the blastocyst cavity
 - II. the epiblast layer which is made up of high columnar cells, and it adjacent 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 adjacent to 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 edematous and highly vascular

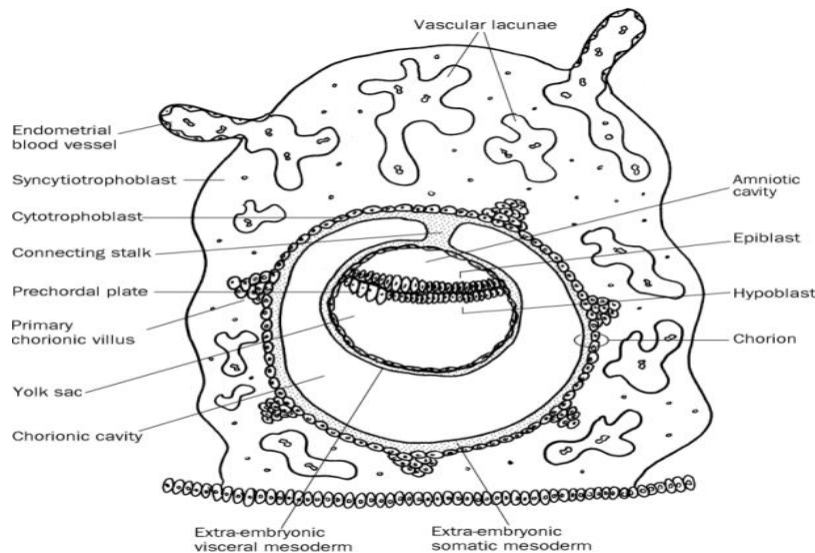


Day 9

- The blastocyst is more deeply embedded in the endometrium, and 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 larger lacunae
- this phase of trophoblast development is known as the lacunar stage
- the cells of the hypoblast adjacent to the cytotrophoblast form a thin membrane called the exocoelomic (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, or primitive yolk sac or primary umbilical vesicle

11th - 12th day of development

- 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 stroma(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 uteroplacental circulation



- When maternal blood flows into the lacunae, oxygen and nutritive substances 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 which are derived from yolk sac cells 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 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
- 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

th
13 day of development

- 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
- 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 fetus 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 or extraembryonic coelom
- 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

Clinical correlate

- The syncytiotrophoblast produces a hormone called the human chorionic gonadotrophin (hCG), which enters the maternal blood via lacunae keeps the corpus luteum secreting estrogens and progesterone
- hCG maintains the hormonal activity of the corpus luteum in the ovary during pregnancy
- hCG can be detected in maternal blood or urine as early as day 10 of pregnancy and is the basis for pregnancy tests
- Enough hCG is produced by the syncytiotrophoblast at the end of the second week to give a positive pregnancy test, even though the woman is probably unaware that she is pregnant

Extrauterine Implantation

- Blastocysts may implant outside the uterus
- These implantations result in ectopic pregnancies
- 95% to 98% of ectopic implantations occur in the uterine tubes, most often in the ampulla and isthmus

