Chapter 4
Second week of development
bilaminar germ disk

TROPHOBLAST:

1. **Cytotrophoblast**: inner, mononucleated cells
2. **Syncytiotrophoblast**: outer multinucleated zone

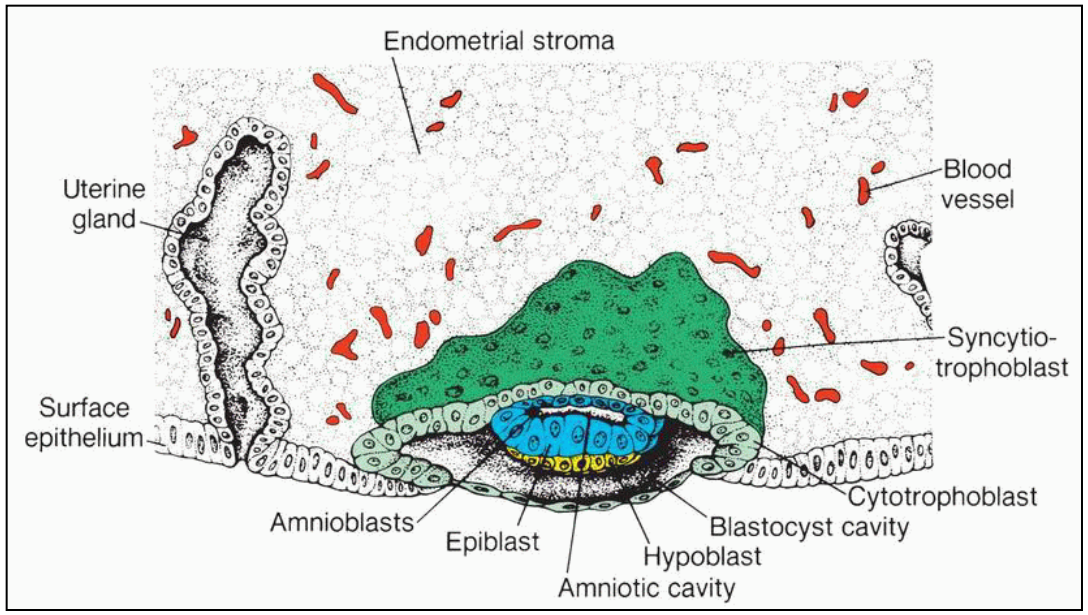
Cells in the cytotrophoblast divide and migrate into the syncytiotrophoblast.

EMBRYOBLAST:

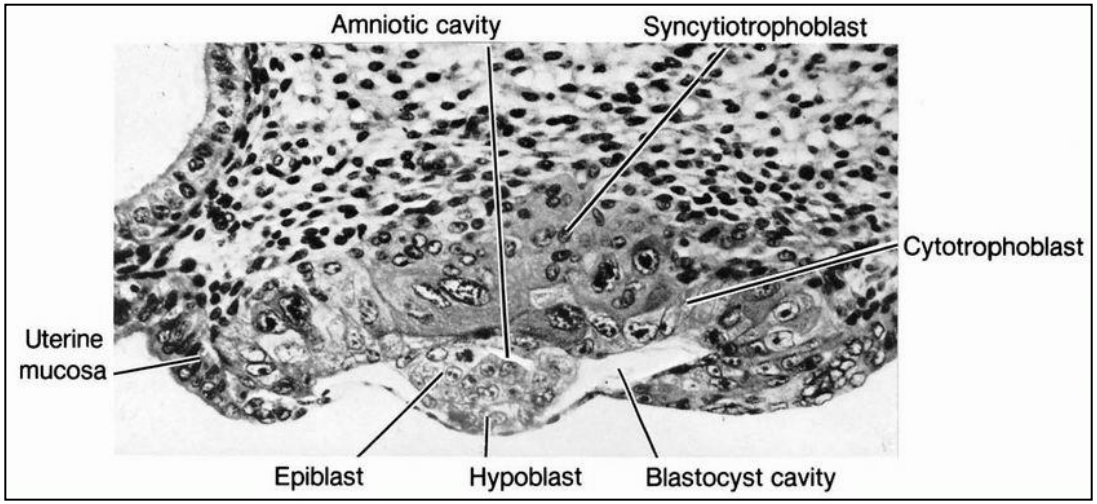
1. **Epiblast**
2. **Hypoblast**

1. **AMNIOTIC CAVITY**: a small cavity within the epiblast .
2. **BLASTOCYST CAVITY**

8-day human blastocyst



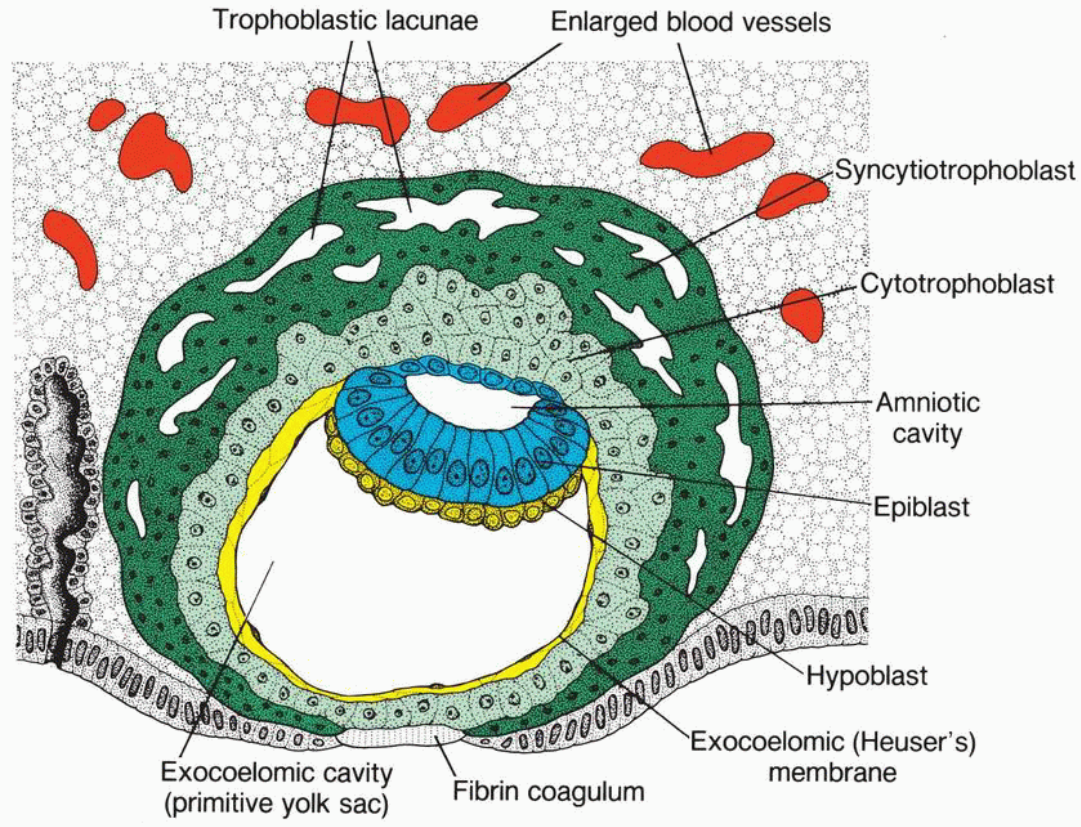
Section of a 7.5-day human blastocyst



DAY 9 - LACUNAR STAGE

- **Syncytiotrophoblast: lacunae.**
- **Primitive yolk sac (Exocoelomic cavity):** Exocoelomic membrane (Hauser's membrane): originate from hypoblast, line cytotrophoblast.
- **The bilaminar disc** :epiblast cells & hypoblast cells.
- **Endometrium:** the penetration defect in the surface epithelium is closed by a fibrin coagulum.

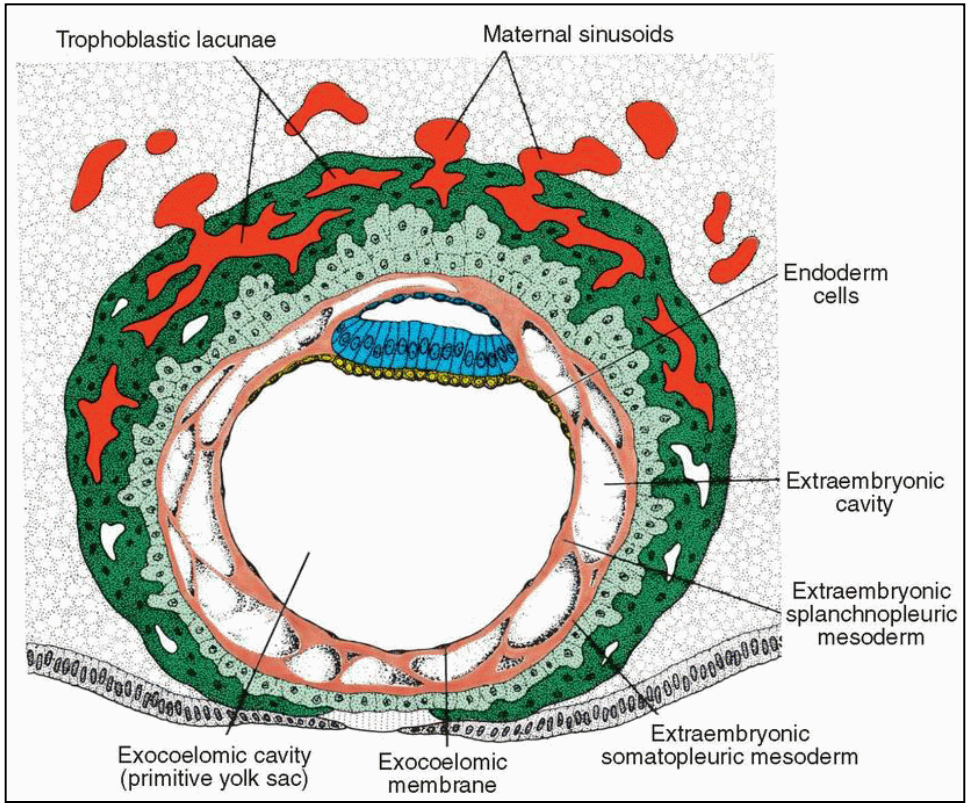
Human blastocyst at day 9



Day 11 and 12

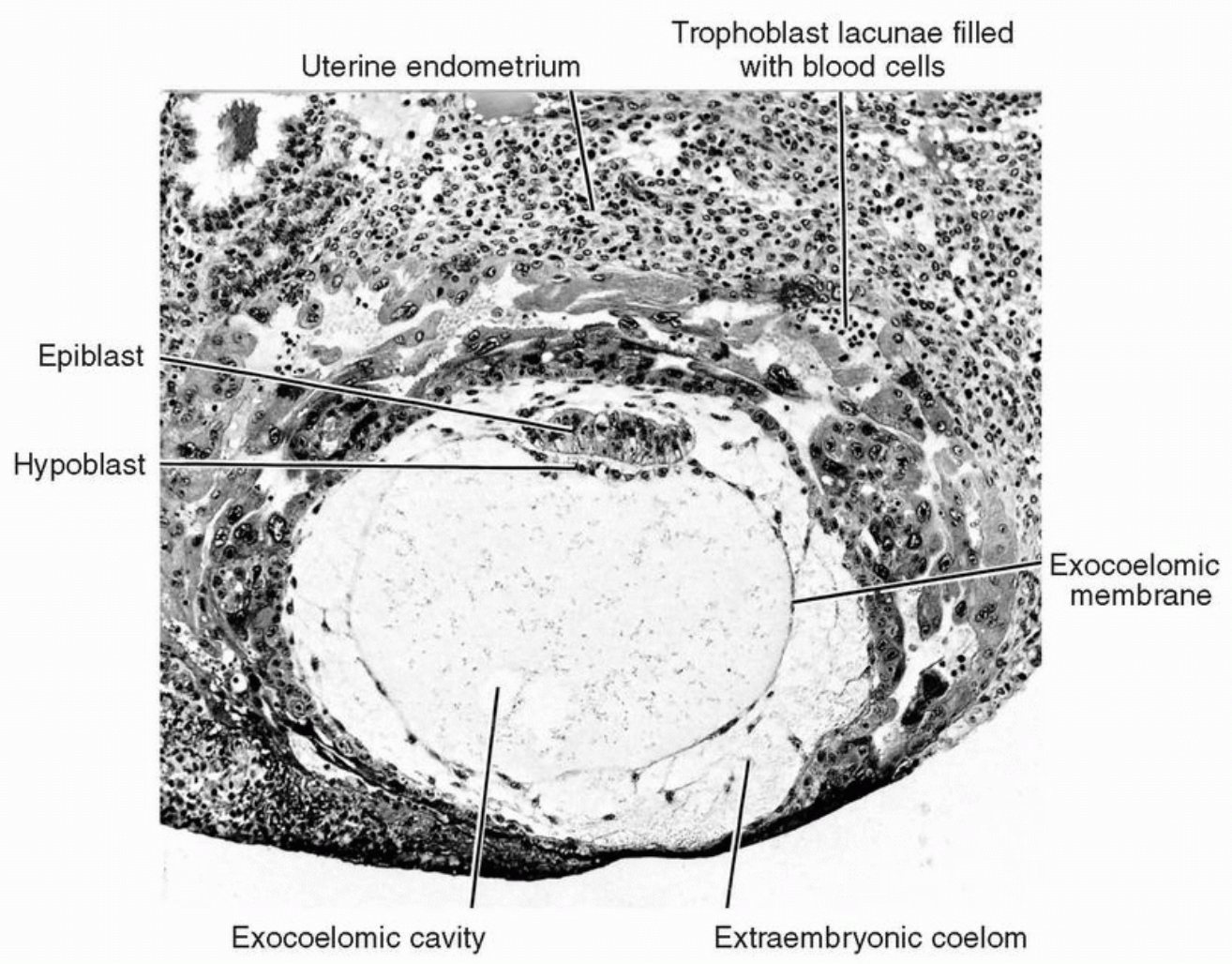
- Surface epithelium: completely closed.
- **Trophoblastic lacunae**: connection with maternal sinusoids → uteroplacental circulation.
- **Extraembryonic mesoderm** (originates from yolk sac), proliferates and fills the space between the exocoelomic (yolk sac) cavity and the inner aspect of the cytotrophoblast .

- The **extraembryonic coelom (chorionic cavity)** forms within the extraembryonic mesoderm.
- The **extraembryonic somatopleuric mesoderm**: covering the cytotrophoblast and amnion.
- The **extraembryonic splanchnopleuric mesoderm**: covering the yolk sac.
- The **decidua reaction**: endometrial cells are loaded with glycogen and lipids; intercellular spaces are filled with extra vasate, and the tissue is



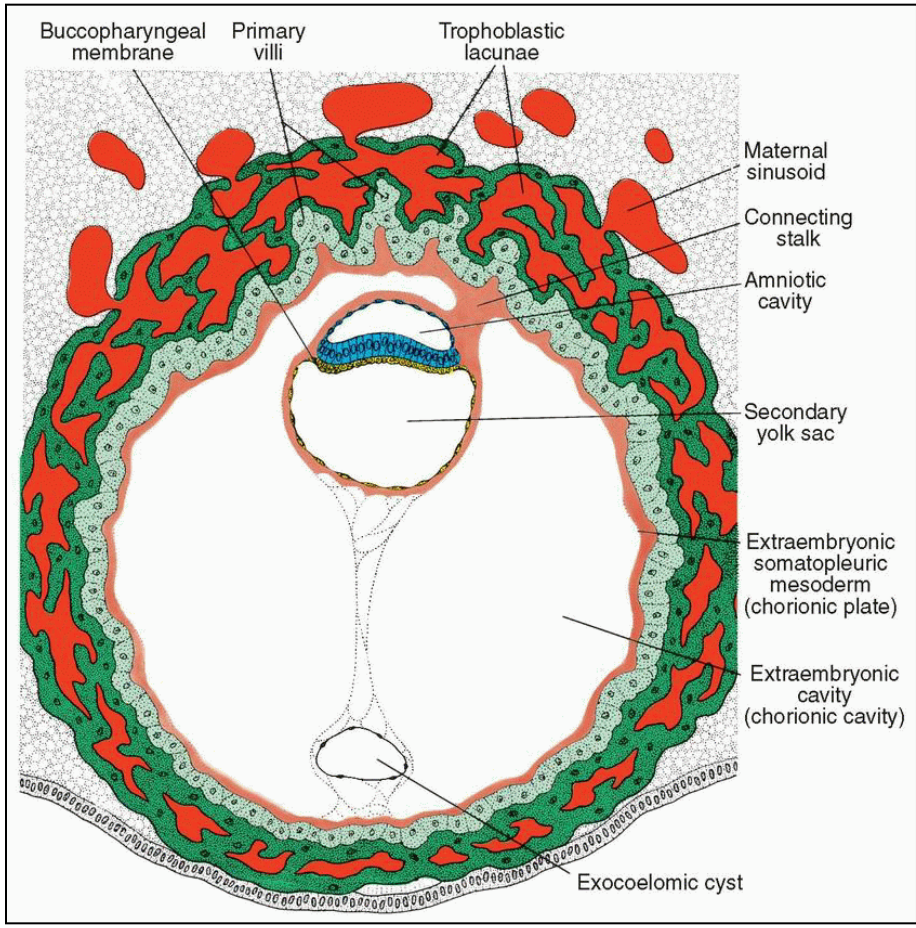
Human blastocyst at DAY 12

Fully implanted 12-day human blastocyst (_100). Note maternal blood cells in the lacunae, the exocoelomic membrane lining the primitive yolk sac, and the hypoblast and epiblast .



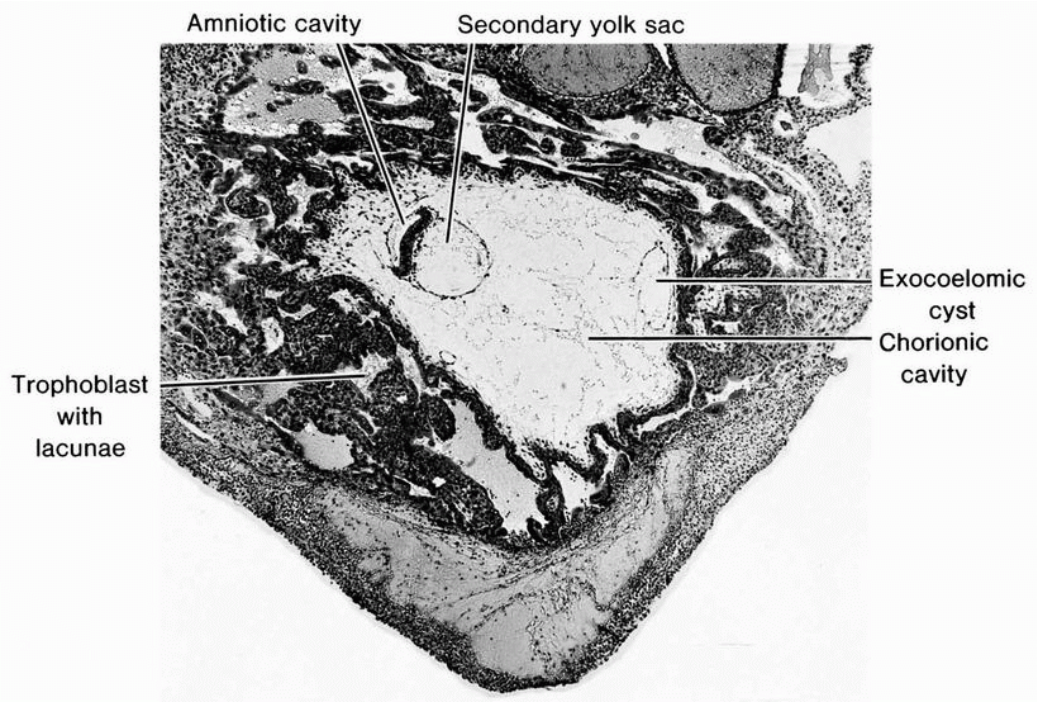
DAY 13

- Defect of endometrium healed.
- Increased blood flow into lacunar spaces→ Bleeding at implntation site→ confused with menstrual bleeding (at day 28) → inacuracy of EDD.
- **Primary villi**: cytotrophoblast columns covered by syncytiotrophoblast.
- **Secondary (definitive) yolk sac** (originate from hypoblast cells) forms within exocoelomoic cavity.
- **Exocoelomic cysts**: remnants of exocoelomic cavity.
- **Chorionic (extraembryonic) cavity** : enlarged.
- **Chorionic plate: mesoderm lining chorionic cavity** (and cytotrophoblast).
- **The extraembryonic somatopleuric mesoderm**: lining of the cytotrophoblast and amnion.
- The **extraembryonic splanchnopleuric mesoderm**: mesoderm covering the yolk sac.
- The only place where extraembryonic mesoderm traverses the chorionic cavity is in the **connecting stalk** (that will become the umbilical cord with development of blood vessels).



Human blastocyst at Day 13

Section through the implantation site of a 13-day embryo. Note the amniotic cavity, yolk sac, and exocoelomic cyst in the chorionic cavity. Most of the lacunae are filled with blood .



CLINICAL CORRELATES

hCG

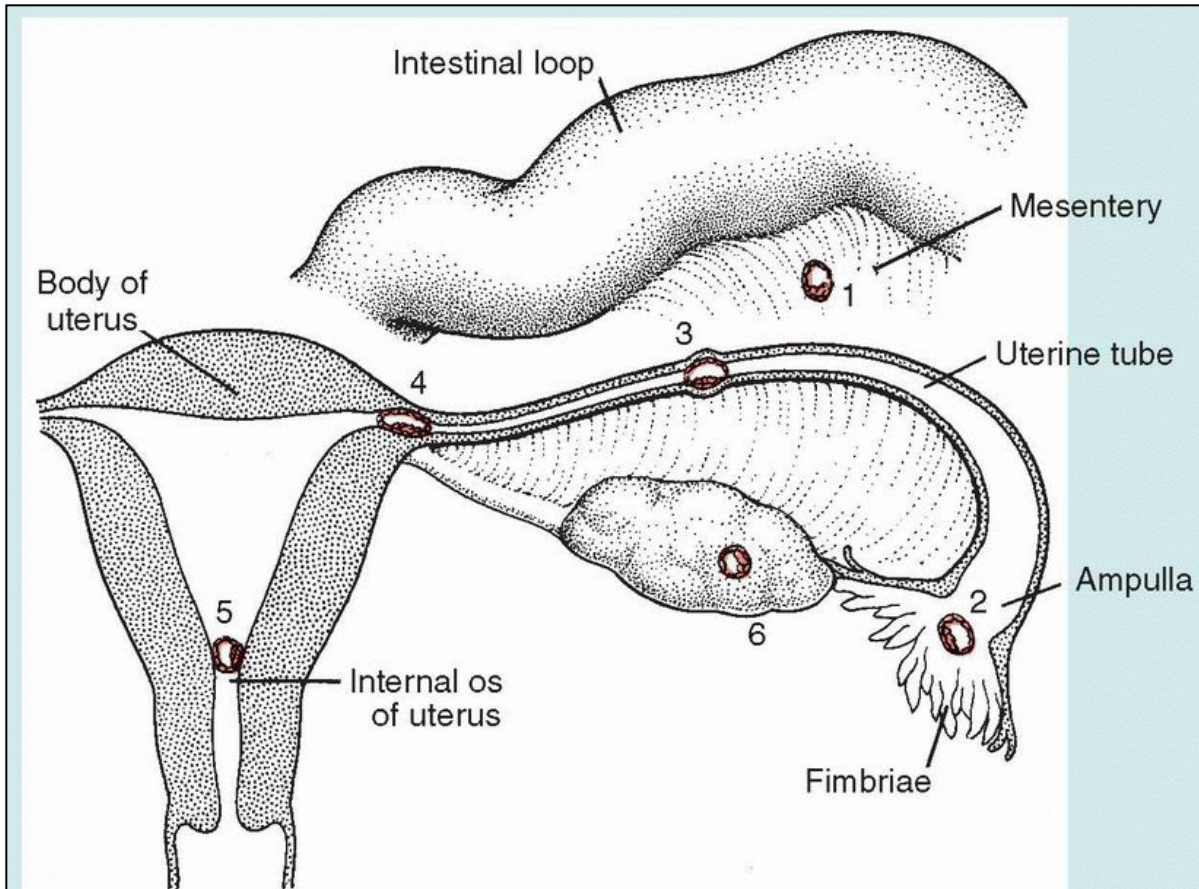
- The syncytiotrophoblast is responsible for hormone production including human chorionic gonadotropin (hCG).
- By the end of the second week, quantities of this hormone are sufficient to be detected by radioimmunoassays, which serve as the basis for **pregnancy testing**.

Abnormal implantation sites

- Normally, the human blastocyst implants along the **anterior or posterior wall of the body of the uterus.**
- **Placenta previa:** blastocyst implants close to the internal os of the cervix→ later in development the placenta bridges the opening→ severe, even life-threatening bleeding in the second part of pregnancy and during delivery

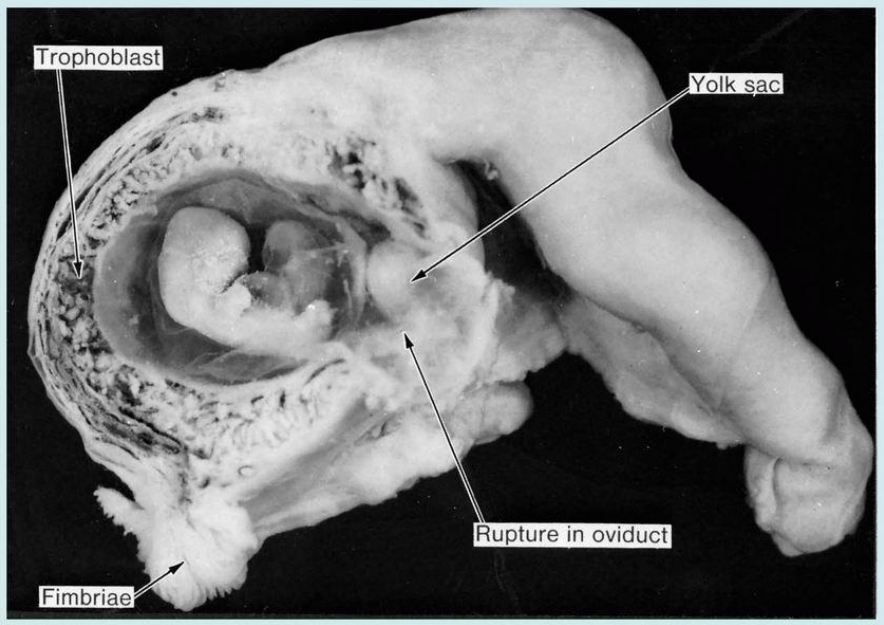
EXTRAUTERINE (ECTOPIC) PREGNANCY

- Rectouterine cavity [pouch of Douglas]
- Ampullary region of uterine tube
- Tubal implantation
- Ovarian implantation.

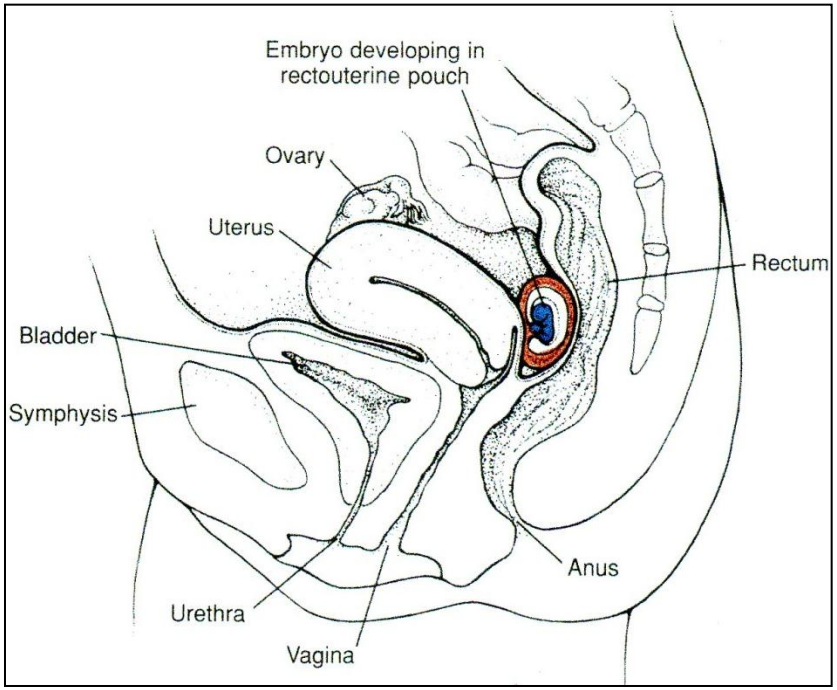


Tubal pregnancy

Embryo is approximately 2 months old and is about to escape through a rupture in the tubal wall .



Midline section of bladder, uterus, and rectum shows an abdominal pregnancy in the rectouterine (Douglas) pouch .



- In most ectopic pregnancies the embryo dies about the second month of gestation and may result in sever hemorrhaging in the mother.

Hydatidiform mole

- Trophoblast develops but no embryonic tissue is present.
- Moles secrete high levels of human chorionic gonadotropin, **hCG**, and may produce benign or malignant (invasive mole, choriocarcinoma) tumors.
- **Genetic analysis of hydatidiform moles** :

1. Although cells of moles are diploid, the **entire genome is paternal**. Thus, most moles arise from fertilization of an oocyte lacking a nucleus followed by duplication of the male chromosomes to restore the diploid number.
2. **Paternal genes regulate most of the development of the trophoblast**, because in moles this tissue differentiates even in the absence of a female pronucleus.
3. **Genomic imprinting.**

WEEK OF TWOS

- The second week of development is the week of twos:
- **The trophoblast**: the cytotrophoblast and syncytiotrophoblast.
- **The embryoblast**: the epiblast and hypoblast.
- The extraembryonic **mesoderm**: the **somatopleure** and s**planchnopleure**.
- Two cavities, the **amniotic** and **yolk sac cavities.**