Placenta & Uteroplacental Circulation
Uteroplacental circulation (2nd week)

- By the 9th day, lacunae (small spaces) develop in the syncitiotrophoblast
- By the 12th day the dispersed lacunae form lacunar networks
- Meanwhile, endometrial capillaries form sinusoids
- Blood will flow between the sinusoids and the lacunar networks forming the uteroplacental circulation
Development of chorionic sac

• **Primary chorionic villi** begin to appear by the end of the second week, induced by the extraembryonic somatic mesoderm

• Extrembryonic somatic mesoderm + cytotrophoblast + syncytiotrophoblast = **Chorion** = walls of chorionic (gestational) sac

• The Extrembryonic coelom become **chorionic cavity**
Development of the chorionic villi

- Primary chorionic villi → secondary chorionic villi (with mesenchymal tissue inside) → tertiary chorionic villi (with blood vessels inside)
- Cytotrophoblastic cells proliferate and form cytotrophoblastic shell that surrounds the chorion and attach it to the endometrium
- Exchange occur between the embryonic blood in the BV of the tertiary chorionic villi and the maternal blood in the intervillous spaces
The Placenta

- Placenta is the site of exchange (nutrients and wastes) between the mother and the fetus
- Placenta is composed from two parts:
  - Fetal portion, which is part of the chorion; the villous chorion
  - Maternal portion, which develop from the endometrium; the decidua basalis
The Placenta

- **Decidua** is the functional part of endometrium that will be expelled after parturition

- The decidua composed of three regions:
  - **Decidua basalis**, which is the maternal portion of the placenta
  - **Decidua capsularis**; part of the endometrium surrounding the chorion (smooth chorion by the 8th week) and facing the uterine cavity
  - **Decidua parietalis** (decidua vera); the remaining part of decidua lining the uterus
The placenta

- At the end of the 20th week,
  - the placenta is enlarged
  - The amnion fuse with the chorionic sac forming amniochorionic membrane
  - The decidua capsularis degenerate and the amniochorionic membrane adhere to the decidua parietalis
In the full term placenta:

- Cytotrophoblastic shell will anchor the fetal placenta to the decidua basalis.
- Placental septa will develop from the decidua basalis toward the chorionic plate dividing the fetal placenta into cotyledons.
- Each cotyledon contains two or three stem villi (anchoring villi), which are surrounded by the intervillous spaces that develop from the lacunar networks.
Full term placenta

- Each stem chorionic villus contain many branch villi
- Chorionic villi contain fetal blood vessels that is branched from BV in the chorionic plate, which are branched from the umbilical BVs
- Exchange happen through the placental membrane, which consists from:
  - Syncytiotrophoblast
  - Cytotrophoblast
  - Connective tissue
  - Capillaries endothelium
- Cytotrophoplastic cells begin to disappear and then capillaries come in direct contact with syncytiotrophoblast
Full term placenta

• The maternal blood in the intervillous spaces come from the **spiral endometrial arteries**, which discharge blood through the cytotrophoblastic shell.

• The deoxygenated blood in the intervillous spaces drained by the **endometrial veins**.
Amnion

- The **amnion** consists of the **amniotic sac** that is filled with **amniotic fluid**
- The amniotic sac attached to the embryonic disc and with the folding of the embryo it surrounds the embryo attaching to it ventrally and covering the umbilical cord
- The amnion enlarges obliterating the chorionic cavity and come in contact with the chorionic sac
Amniotic fluid

• Source of amniotic fluid:
  • Secreted from the amniotic cells
  • From maternal tissue, through fetal membranes
    • From decidua parietalis through amniochorionic membrane
    • From blood in the intervillous space through chorionic plate
  • From the fetus
    • Through the skin before skin keratinization
    • From fetal respiratory tract
    • Fetal urine by 11th week

• Amniotic fluid diffuse back to maternal tissue
  • Directly through the fetal membranes
  • Indirectly by fetal blood stream; fetal swallow the amniotic fluid which is absorbed into the blood stream and then either return to mother blood through placenta or execrated as fetal urine
Amniotic fluid

- Amniotic fluid functions
  - Protection of the fetus
  - Helps control fetal temperature
  - Fetal fluid and electrolytes homeostasis
  - Aids in fetal development
    - Symmetrical external growth
    - Muscular development through movement
    - Lung development
The umbilical vesicle (yolk sac)

- Yolk sac forms in the 2nd week ventral to the embryonic disk
- When the embryo begins folding the yolk sac will be incorporated with the umbilical cord and connected to the midgut with yolk stalk
- By the end of the 6th week the yolk stalk detaches from the midgut loop
- By the 20th week, yolk sac is very small and usually not visible
- Yolk sac significance
  - Nutrition to embryo in the 2nd and 3rd weeks
  - Blood vessels development
  - Participate in forming the respiratory and GI tracts
  - Origin of the germ cells