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 $\rightarrow$ **secondary chorionic villi** (with mesenchymal tissue inside) $\rightarrow$ **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 contains many branch villi.
- Chorionic villi contain fetal blood vessels that are branched from BV in the chorionic plate, which are branched from the umbilical BVs.
- Exchange happens through the placental membrane, which consists of:
  - Syncytiotrophoblast
  - Cytotrophoblast
  - Connective tissue
  - Capillaries endothelium
- Cytotrophoblastic 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