Implantation

- Begins on the 6th day after fertilization
- Embedding of blastocyst in the wall of uterus
- Disappearance of zona pellucida
- Cells of the trophoblast stick to the endometrium
- After implantation of the embryo, the uterine endometrium is called the decidua
Implantation
Site of implantation

- **Normal site** - At the junction of fundus and posterior wall of uterus

- At upper uterine segment
Interstitial Implantation
The Decidua

After implantation of the embryo, the uterine endometrium is called the decidua.
Subdivisions of Decidua
Formation of Chorionic Villi

- Villi are the essential functional elements of the placenta.
- Small finger-like processes.
- Surrounded by maternal blood.
- Fetal blood circulates in their substance through capillaries.
- Called as **Chorionic villi** as arises as offshoots from chorion.
Stages in formation of Chorionic villi
Early stages in formation of Chorionic villi (9\textsuperscript{th} day)
Formation of Chorionic villi

A

- Decidua
- Lacunar space
- Trabeculae

B

- Lacunar space completely surrounding each trabeculus

Diagram:
- Decidua basalis
- Cytotrophoblast
- Connecting stalk
- Syncytiotrophoblast containing radially arranged trabeculae
- Extraembryonic coelom
- Decidua capsularis
Lacunar spaces filled with maternal blood
Primary Villus (Day 13-14)

All elements (syncytium, cytотrophoblast and extraembryonic mesoderm) take part in formation of chorionic villi. Three stages in formation of chorionic villi are seen:

**Primary villus:** central core of cytотrophoblast covered by a layer of syncytiotrophoblast. Adjoining villi are separated by an intervillous space.
Secondary Villus (Early 3rd week)

Central core of extraembryonic mesoderm covered successively by cyto and syncytiotrophoblasts.
Tertiary Villus (End of 3rd week)

Appearance of blood vessels in the mesoderm forming core of each villus.
Formation of cytotrophoblastic shell

- Maternal blood vessels in decidua
- Cytotrophoblastic shell
- Syncytiotrophoblast
- Maternal blood in intervillous space
- Cytotrophoblast
- Capillary in villus
- Fetal blood vessels in extraembryonic mesoderm
Anchoring villi & its subdivisions

- Maternal surface
- Ramus chori
- Truncus chori
- Intervillous space
- Umbilical cord
- Fetal surface
- Anchoring or stem villus
- Intervillous space
Fully formed Placenta (4\textsuperscript{th} month)
DEFINITION

• Placenta is a fetomaternal organ which is the primary site of nutrient and gas exchange between the fetus and the mother.

• Human Placenta is discoidal, haemochorial, chorioallantoic and deciduate.
• Latin-cake
• Greek - a flat cake
• Is a union between developmental adenexa (extra-embryonic membranes and the uterine mucosa) for physiological exchange.
Placenta at Term

The Placenta at Term

Umbilical arteries

Umbilical vein

THE MATERNAL CIRCULATION

THE FOETAL CIRCULATION

SCHEMA OF VILLOUS ORGANIZATION
Gross Anatomy of Placenta

- **Shape**
  - Disc like

- **Surface**
  - Foetal surface
  - Maternal surface
PLACENTA AT TERM

- Expelled placenta-flat discoidal
  - Volume- 500ml (200-950ml)
  - Weight- 500gms(200-800gms)
  - Diameter- 185mm(150-200mm)
  - Thickness- 23mm(10-40mm)
  - Surface area-30,000 cubic mm

- Placenta & decidua are shed off after the birth.
MATERNAL SURFACE

Fine granular, 15-30 lobes called cotyledons separated by placental septa.

FETAL SURFACE

Smooth, covered by amnion, shiny, transparent, mottled appearance, vessels radiating out. Umbilical cord is attached.
PLACENTAL MEMBRANE

- Total area: 4-14 square metres
- Early: 0.025mm
- Later: 0.002mm

In early pregnancy

Barrier formed by
1. Syncytium
2. Cytotrophoblast
3. Connective tissue
4. Endothelium

In later pregnancy

Barrier formed by
1. Syncytium
2. Endothelium
The full-term placenta showing the maternal and fetal portions (Enlarged view to show placental membrane)

- Basement membrane
- Fetal capillary
- Connective tissue
- Syncytiotrophoblast
- Cytotrophoblast
- Maternal blood in intervillous space
Placental Circulation

- Foetal placental circulation
  - umbilical vein
  - chorionic veins
  - arteriocapillary venous system of villi
  - chorionic arteries
  - umbilical arteries

- Maternal placental circulation
PLACENTAL CIRCULATION
Functions of Placenta

1. Organ of respiration
2. Nutrition
3. Excretion
4. Immunological protection
5. Protective barrier
6. Production of hormones
   - human chorionic gonadotropin
   - estrogen, progesterone
   - somatomammotropin
 FUNCTIONS OF PLACENTA

**Waste Products**
- Carbon dioxide, water, urea, uric acid, bilirubin

**Other Substances**
- RBC antigens
- Hormones

**Oxygen and Nutrients**
- Water
- Carbohydrates
- Amino acids
- Lipids
- Electrolytes
- Hormones
- Vitamins
- Iron
- Trace elements

**Harmful Substances**
- Drugs (e.g., alcohol)
- Poisons and carbon monoxide
- Viruses (e.g., Rubella, Cytomegalovirus, Toxoplasma gondii)

**Nontransferable Substances**
- Bacteria, heparin, transferrin, IgS, and IgM

**Other Substances**
- Antibodies, IgG, and vitamins

**Figure 7-9.** Diagrammatic illustration of transfer across the placental membrane (barrier). The extrafetal tissues are enclosed by a syncytiotrophoblast wall.
Functions of Placenta

• Enables the transport of oxygen, water, electrolytes and nutrition (carbohydrates, lipids, polypeptides, aminoacids & vitamins) from maternal to fetal blood.

• Excretion of carbon dioxide, urea etc. by the fetus into the maternal blood.
Contd……

- Acts as a barrier (bacteria, viruses, drugs).

- Maternal antibodies (IgG) gives immunity to the fetus.

- Keeps the maternal & fetal blood streams separate, thereby preventing antigenic reactions.
Placental Hormones

• hCG (human chorionic gonadotropin):
  - Excreted through maternal urine
  - Used as a test to detect pregnancy

• hCS (human chorionic somatomammotropin):
  – hCS has an anti-insulin effect on mother
  – Also enhances glucose utilization by the fetus
Placental Hormones

• Progesterone:
  - For maintenance of pregnancy after 4\textsuperscript{th} month (when the corpus luteum degenerates).

• Oestrogen (mainly estriol):
  – Uterine growth
  – Development of mammary gland
CLINICAL CORRELATION

Abnormal Sites of Implantation:
- Within the uterus
  Placenta Praevia

- Outside the uterus
  Tubal pregnancy
  Interstitial tubal
  Ovarian implantation
Anomalies of Placenta

A. Bidiscoidal
B. Lobed
C. Diffuse
D. Placenta succenturiata
E. Fenestrated
F. Circumvallate
Succenturiate lobe
Circumvallate Placenta
Anomalies of Placenta

A. Normal
B. Marginal
   (Battledore placenta)
C. Furcate
D. Velamentous insertion
Abnormalities of placenta

Abnormal penetration of uterine wall
- Placenta Accreta
- Placenta Incerta
- Placenta Percreta
Relationship of amniotic cavity, extra-embryonic coelom & uterine cavity
Decidua capsularis (green)
Decidua parietalis (light green)
Decidua parietalis (dark green)
Chorion (pink)
Placenta
Amnion (blue)
Uterine cavity
Amniotic cavity
Umbilical cord

Note that amnion and chorion have fused to obliterate the extraembryonic coelom

Uterine cavity has been obliterated by fusion of decidua capsularis and decidua parietalis

'Membranes' (fused amnion, chorion, and decidua capsularis) lie over the internal os.
Twinning

- Mother giving birth to two infants at the same time.
- 2 types of twins:
  - Dizygotic (fraternal)
  - Monozygotic (maternal)
Derivation of Triplets
Derivation of Quadruplets
REFERENCES


1. The portion of the decidua where the placenta is to be formed:
   a) Decidua basalis
   b) Decidua capsularis
   c) Decidua parietalis
   d) All of the above
2. Secondary chorionic villus is characterized by:

a) Cytotrophoblast, syncytiotrophoblast and extra-embryonic mesoderm with fetal blood vessels
b) Cytotrophoblast, syncytiotrophoblast and extra-embryonic mesoderm
c) Cytotrophoblast and syncytiotrophoblast
d) Syncytiotrophoblast only
MCQs

3. All are layers of placental barrier *except*: 

a) 2 layers of trophoblast  
b) Mesoderm  
c) Endothelium of fetal blood vessel  
d) Septum
4. Attachment of umbilical cord at the margin of placenta is called:

a) Furcate
b) Battledore
c) Circumvallate
d) Fenestrated
5. The condition in which placenta extends into the lower uterine segment:

a) Placenta succenturiata
b) Battledore placenta
c) Circumvallate placenta
d) Placenta praevia