Embryonic Development

Spermatogenesis

- Sperm formed in the testes and contained in the scrotum
  - Production is continuous and each ejaculate contains on average 2-5 ml semen which contain about 100 million sperm per ml

Oogenesis

- Ova are formed in ovary
  - 500,000 present at birth
  - Only 200-300 reach maturity
  - Each menstrual cycle corresponds to maturation of oocyte which becomes ovum
  - Only one per month reaches maturity

Formation of Gametes

The nucleus of the sperm and ova contain: 23 chromosomes each (22 autosomes/1 sex chromosome)

Fertilization *"Passage of sperm into an ovum"*

- Outer 1/3 of fallopian tube
- High EST during ovulation which increases ability of fallopian tubes to contract and move egg down the tube.
- Takes a few hours for sperm to reach fallopian tube
  - Only 2,000 sperm make it

Sperm Penetration and Maturation (takes 20-30 seconds):

- Requires sperm enzyme hyaluronidase which helps the sperm penetrate the ovum cell.
- Only 1 sperm head enters the egg.
- Sperm head detaches, maturation happens and size increases to reach center of egg and that sperm head then becomes a pronucleus within the ovum cell.

Consequences of Fertilization:

- Ovum matures becomes a female pronucleus
- Chromosomes pair up and a new cell called a zygote is created, genetic foundation laid
- Chromosomal abnormalities happen at the moment of fertilization
- New cell "Zygote" should have 46 chromosomes
- Inherited traits and characteristics are determined

Early Embryo Development

- Cleavage: Rapid cell division of the zygote
- Blastomeres: Cells of early division
- Morula: Solid ball of cells that have divided
- Blastocyst: developing structure of the embryo
- Trophoblasts: Outer layer
  - Embryoblasts: Inner layer

Implantation

- Occurs 7-10 days after fertilization
- Depends on vascular changes of endometrium

- Blastocyst cells burrow into endometrium
- Implantation of blastocyst about 6 to 10 days after conception
- Endometrium was ready for this due to hormones and premenstrual swelling

Decidua

- Several days after implantation
  - Altered mucus membrane of endometrium becomes decidua
- Decidua is under the control of HCG secreted by trophoblast cells
  - Prevents menstrual sloughing
  - Encourages growth in thickness and vascularity of endometrium
  - Protects and nourishes the embryo
- After birth it becomes lochia

Portions of the Decidua

- Decidua capsularis
  - Covers the blastocyst
- Decidua basalis
  - Directly under the implanted embryo
  - Forms _____
- Decidua vera
  - Lines the rest of the uterus as a whole

Embryonic Membranes: The Amnion

- Thin, inner membrane
- Develops from the interior cells of blastocyst
- Contains amniotic fluid
- Protects and supports the embryo as it grows/develops
- Becomes the outer covering of the _____

Embryonic Membranes: The Chorion

- Thick, outer membrane
- Develops from trophoblast and contains chorionic villi
- Chorionic villi (fingerlike projections) on surface burrow into decidua basalis to develop into the placenta, (turns into a smooth surface by month 4)
- Can be genetically tested at 8-10 wks

Amniotic Fluid

- Clear to slight yellow, 700ml to 1000ml by full term
- 98% water and 2% inorganic solids
- Slightly alkaline
- Continuously rapidly replaced/reabsorbed

Function of Amniotic Fluid

- Maintains constant body temp
- Source of oral fluid and repository for waste
- Maintenance of fluid/electrolyte balance
- Cushions/Protects/Allows symmetrical growth
- Fluid analysis to check for: _____

Amniotic Fluid Volumes

- 30 ml at 10 weeks and increases weekly
- 700 ml-1 Liter at term
- Polyhydramnios:
- Oligohydramnios:

The Placenta

- Origin of Placenta- 4/5 of fetal origin (trophoblasts), 1/5 of maternal origin (uterus)
- Clearly defined by 3 months
- Limited exchange until after 3-5 months
- Continues to grow until 7th month
- Begins to shrink after 8 months
- At term: 20cm diameter, 3cm thick, 400-600Gm in weight

Placenta function:

Umbilical Cord (formed from yolk sac stalk)

- Leaves placenta & connects to fetus
- Cord covered by amnion & Wharton's jelly
- Size
- Arteries & Veins

Fetal Circulation

- Closed vascular system; Transfer of substances through chorionic villi
- Exchange through differences in pressure (diffusion)

Yolk Sac

- Develops 8-9d after conception
- Function:
  - Forms primitive RBC's first six weeks
  - Nourishes embryo until implantation
- Atrophies and becomes part of fetal digestive system and umbilical cord

Primary Germ (Cell) Layers

- Primary germ layers eventually develop into all organ systems, organs, and tissues
- Developed from differentiating blastocyst cells about 10-14d after conception
- Three layers: Ectoderm, Mesoderm, Endoderm
- Formed at same time as the embryonic membranes

Ectoderm: Outer Layer:

Mesoderm- Middle Layer:

Endoderm: Inner Layer: