Embryonic Development- 2023

Spermatogenesis

- Gametes: sperm & egg
- Spermatocytes are formed in testes
- Production is continuous

Oogenesis

- Ova are formed in ovary
  - Born with 2 million oocytes
  - 400-500 mature
  - 1 menstrual cycle = 1 mature oocyte = 1 ovum
  - Only one per month

Formation of Gametes

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

Fertilization

- Outer 1/3 of fallopian tube
- High EST during ovulation
  - Increases contractability of fallopian tube
  - Helps move ovum
  - Thins cervical mucus
  - Facilitates penetration of sperm
- Takes a few hours (4-6) for sperm to reach fallopian tube

Sperm Penetration

- Requires enzyme: hyaluronidase
  - Takes 20-30 seconds
- Only one sperm enters
  - Head detaches
  - Enlarges
  - Moves to center
  - Becomes “male pronucleus”

Once Ovum is penetrated:

- Ovum matures
  - “female pronucleus”
- Both pronuclei unite
- **Union = “zygote”**
  - Chromosones are paired
  - Beginning of genetic foundation!
- Chromosomal abnormalities happen at the moment of fertilization

Early Embryo Development

- Zygote
  - 24 hours in the fallopian tube

- Rapidly divides → morula → trophoblast & embryoblast → blastocyte

Implantation

- Occurs 6-10 days after fertilization
- Endometrium prepared:
  - Thicker
  - Vascular
- Blastocyst burrows into endometrium
- Implantation
  - Bleeding may occur

Primary Germ (Cell) Layers

- Develop 10-14 days after conception
- Arise from blastocyst cells
- Three layers:
  - Ectoderm
    - Nervous System:
      - brain, ganglia, spinal cord
    - Epidermis- Skin
      - Sebaceous and sweat glands
      - Enamel of teeth
      - Hair and Nails
    - Sense organs: ear, nose, eyes
    - Pituitary gland
  - Mesoderm
    - Musculoskeletal
    - Spleen
    - Urogenital system
    - Reproductive system
    - Teeth
    - Cardiovascular system
  - Endoderm
    - Respiratory/digestive epithelium
    - Urethra & Bladder
    - Liver
    - Pancreas
    - Vagina

Embryonic Membranes: The Amnion

- Thin, Inner membrane
- Begins to develop week 2
- Surrounds embryo in membranous sac
- Contains amniotic fluid
- Becomes outer covering of umbilical cord

Embryonic Membranes: The Chorion

- Thick, outer membrane
- Develop from trophoblast
- Chorionic villi on surface

- By month 4 become smooth except for where attached to uterus
- Early genetic testing
  - 8-10 wks

Amniotic Fluid

- Clear to slight yellow
- Continuously rapidly replaced/reabsorbed
- 10 mL by week 8
- 250 mL by week 16
- 800 mL by week 32
- 500 mL at week 41

Function of Amniotic Fluid

- Freedom of movement
- Protection
- Temperature control
- Fluid & electrolyte homeostasis
- Oral fluid as fetus swallows/then excretes
- Symmetrical growth

Amniotic Fluid Volumes

- Polyhydramnios
  - Over 2000ml at birth
  - Fetus unable to swallow
- Oligohydramnios
  - Less 300ml at birth
  - Fetal renal problems

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

The Umbilical Cord

- Leaves placenta
- Connects to fetus
- 40-70 cm in length
- Covered by:
  - Amnion
  - Wharton's jelly
- Cord compression
  - Nuchal Cord
- 2 Arteries
- 1 Vein

The Placenta

- Endocrine gland
- Exchanges nutrients
- Produces hCG, EST, PRO, hPL,
- Interference in circulation
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Placental-Fetal Circulation

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