Fertilization and Development

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Fertilization

✓ A complex interaction between the male and female gametes to form a zygote.

✓ Normally occurs in the ampulla of uterine tube within 24 hours after ovulation.
Fate of follicular cells after ovulation

- Corpus luteum
  Corpus luteum of menstruation
  Corpus luteum of pregnancy
- Corpus albicans
Important events

- Transport of oocyte
- Transport of sperms
- Capacitation
- Acrosome reaction
The egg’s journey through the fallopian tube to the uterus
Steps in Fertilization

- Passage of sperm through the corona radiata
- Penetration of zona pellucida
- Fusion of plasma membranes of the sperm & oocyte
- Completion of the second meiotic division of oocyte
- Formation of female pronucleus
- Formation of male pronucleus
- Fusion of pronuclei
- Formation of a zygote
1 After the sperm penetrates the secondary oocyte, the oocyte completes meiosis II, forming the ovum and second polar body.

2 Sperm and ovum nuclei swell, forming pronuclei.

3 Pronuclei approach each other and mitotic spindle forms between them.

4 Chromosomes of the pronuclei intermix. Fertilization is accomplished. Then, the DNA replicates in preparation for the first cleavage division.
First week of Development (Fertilization to Implantation)

• Approx. 30 hrs. following fertilization, the zygote undergoes repeated mitotic divisions. This is termed as Cleavage.

• Resulting in a rapid increase in the number of cells.

• These cells become smaller with each cleavage division, known as blastomeres.
Early Development

Cleavage in uterine tube
Developmental stages of zygote

- **2 Cell Stage**
- **4 Cell Stage**
- **Morula**
- **Blastocyst**
  - Trophoderm
  - Inner Cell Mass
- **Fertilization**
Implantation

• About 6-7 days after fertilization, the embryo embeds itself into the wall of the uterus.
Early Development

- Morula & blastocyst

- Trophoblast:
  - Cytotrophoblast
  - Syncytiotrophoblast

(c) Morula (a solid ball of blastomeres). 3 days

(d) Early blastocyst (Morula hollows out, fills with fluid, and “hatches” from the zona pellucida). 4 days

Degenerating zona pellucida
Blastocyst cavity

(e) Implanting blastocyst (Consists of a sphere of trophoblast cells and an eccentric cell cluster called the inner cell mass). 7 days

Trophoblast
Blastocyst cavity
Inner cell mass
Early Development

- Implantation
  - Trophoblast forms placenta
  - “Inner cell mass” forms embryo
Early Development

• Placenta
  – Provides large area for exchange of $O_2$, $CO_2$, nutrients, metabolic wastes between fetal and maternal blood.
Abnormal sites of Implantation (Ectopic)

- Tubal: 95–96%
- Interstitial and cornual: 2–3%
- Isthmic: 12%
- Ampullary: 70%
- Fimbrial: 11%
- Ovarian: 3%
- Cesarean scar: <1%
- Cervical: <1%
- Abdominal: 1%
REFERENCES


1. The hormone responsible for development of corpus luteum from ovarian follicle:
   a) Gonadotropin-releasing hormone
   b) Follicle-stimulating hormone
   c) Luteinising hormone
   d) Progesterone
2. Fertilization normally occurs in which part of uterine tube:

a) Infundibulum
b) Ampulla
c) Isthmus
d) Intramural part
3. Passage of sperm through corona radiata occurs due to liberation of:

a) Hyaluronidase
b) Neuraminidase
c) Acrosin
d) Glycoprotein
4. Implantation usually begins after how many days of fertilization:

a) 5
b) 6
c) 7
d) 8
5. The normal site of implantation is:
   a) Posterior wall of uterus near the fundus
   b) Anterior wall of uterus near the fundus
   c) Uterotubal junction
   d) Ampulla of uterine tube