

HUMAN ANATOMY & PHYSIOLOGY-II- BP201T

UNIT: 5 (REPRODUCTIVE SYSTEM)

CLASS: 7

TOPIC: **Fertilization**

The fusion of the sperm cell nucleus with the egg cell nucleus to produce a **zygote** (fertilized egg), brings male and female gametes together – produces diploid zygote. It also activates the egg, triggering the beginning of embryonic development. Several thousand sperm reach the egg and one will fertilize it.

When the sperm fuses with the egg it initiates a series of chemical changes that prevent any other sperm from entering.

Mechanism

1. Encounter of spermatozoa and ova

- During the fertile phase, millions of sperm travel from the vagina to the uterus and into the fallopian tubes.
- Chemotaxis – A chemical substance is found in the cortex of eggs.
- The primary need is a fluid medium for the act of fertilization and delivery of sperm to the eggs at the right time.
- 2 types of fertilization

External: Occurs outside of the body of the female

Eg: fish and amphibians

Internal: Occurs inside the body of the female

Eg: mammals, reptiles, birds

2. Capacitation and contact

Sperm undergo capacitation (further maturation) within the female reproductive tract. Occurs in vagina. Vaginal secretions cause a molecular change in the plasmalemma (removal of decapacitating factor) and get in contact with ova.

3. Acrosome reaction and penetration

When the acrosome reaction occurs a number of proteolytic enzymes release and digest the hole through zona pellucida through which sperm enters the perivitelline space. The penetration is because of the CatSper present in the tail of the sperm.

4. Fusion of sperm with egg

Male nucleus enters the egg cytoplasm and becomes the male pronucleus. Following the secondary meiotic division, the nucleus of the ovum becomes female pronucleus. The haploid male and female pronuclei move towards one another, meet, fuse to form diploid nucleus zygote. Zygote undergo the cleavage.

5. Activation of ovum

A series of morphological, physiological and molecular changes that occur in the egg in response to fusion of the sperm with the egg.

1. Release of Ca^{++} (calcium) stored in the egg endoplasmic reticulum - appears to be the critical step in the process.
2. Cortical reaction - rupture of cortical granules that occurs concurrently with the Ca^{++} release. Contents of granules are released into perivitelline space and cause "hardening" of the vitelline membrane or zona pellucida. Causes vitelline/fertilization membrane to rise away from surface of egg in some species.
3. Influx of Na^{+} (sodium) into the egg cytoplasm that causes a change in membrane potential - fast block to polyspermy.
4. Reorganization of the egg cytoplasm.
5. Completion of meiosis by the egg.
6. An efflux of H^{+} (hydrogen) ions causing an increase in cytoplasmic pH - this activates previously inhibited synthetic pathways.
7. Increase in metabolism - zygote gears up for development.

