

Subject – Biology

Class- 12

Topic – fertilization in human

## Fertilization in Human

### Notes :->

#### \* Fertilization

- > The combination of haploid male & female gametes & fusion of pronuclei of both gametes is called fertilization.
- > Fertilization result in formation of diploid zygote.
- > The Fertilisation takes place in ampulla of the fallopian tube

### Types

#### External

- > Fishes / Labeo
- > Amphibians
- > all the echinodermates (Starfish)

#### Internal

- ① -> Oviparous (aves, protherians)
- ② -> Viviparous (all marsupials & eutherians)

- \* Artificial fertilization :- Sperms are collected artificially, stored after preservation & fertilization is done by inserting and liberating them in female uterus. Ex. livestock breeding improvement.

## Steps of fertilization

1. Approach of sperm to ovule
  - Male ejaculates semen 5-3 ml in the vagina near uterine duct in female is called insemination.
  - 300 million sperm ingested by phagocytes of vaginal epithelium
  - Sperm speed = 1.4 mm/minute
  - The capability of fertilizing an ovum of its own species is capacitation.
  - Fertilization of ovum takes  $\approx$  5-6 hours. It is done due to activity of lysozyme enzyme.
2. Entry of sperm :- Ovum has fertilizin hormone. Fertilizin hormone reacts with anti fertilizin hormone and agglutinize together.
  - Penetration is done by acrosome part which release sperm lysin.
  - Sperm lysin dissolve the covering of ovum.

Sperm lysin (Acidic protein)

↓  
Hyaluronidase enzyme

↓  
which dissolve polymers of hyaluronic acid present in intercellular space.

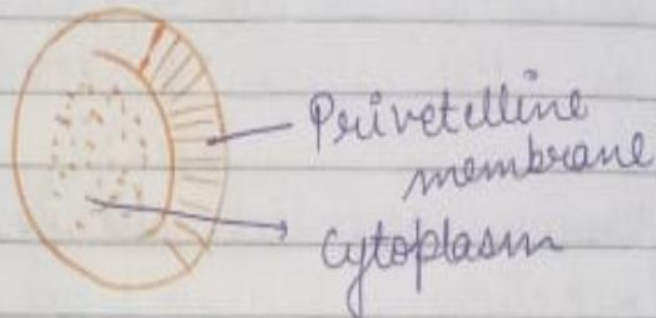
This acid keeps the granular cells of corona radiata together.

- Corona piercing  $\xrightarrow{\text{dissolve}}$  Corona radiata

→ Acrosin dissolve zone pellucida

3. Cortical reaction → Stop the entry of another sperm.

Cortical granules present below the plasmalemma of ovum form barrier to the cytoplasm of ovum and privitelline membrane



⇒ Changes in Ovum

① Fertilization cone

2. Privitelline membrane changes into fertilization membrane.

3. Protein synthesis of plasmalemma increase.

4. Mitotic division begins.

4. Fusion of Pronuclei.

\* Ques / Ans:-

1. Who gave the theory of fertilizin in process of fertilization?  
Frank Rattray Lillie
2. Where is fertilizin present?  
It is a chemical substance <sup>secreted</sup> present in the sperm's acrosome. by ovum.
3. Which scientist studied the acrosome reaction.  
Yanaginachi
4. Define fertilization.  
The combination of haploid male and (sperm) and female (ovum) gametes & the fusion of pronuclei of both gametes is called fertilization.
5. What is parthenogenesis?  
Parthenogenesis is a natural form of asexual reproduction in which growth and development of embryos occur without fertilization.
6. What is amphimixis?  
The fusion of pronuclei of gametes is called karyogamy, while mixing of two sets of chromosomes of two gametes is known as amphimixis.

7. What is activation of sp ovum?  
Cortical Reaction (activation of ovum).

8. What is capacitation process?  
The capability of fertilizing an ovum of its own species is known as sperm's capacitation.

9. Define Insemination.  
The process of liberation of sperms by male in the body of female by internal fertilization is called insemination.

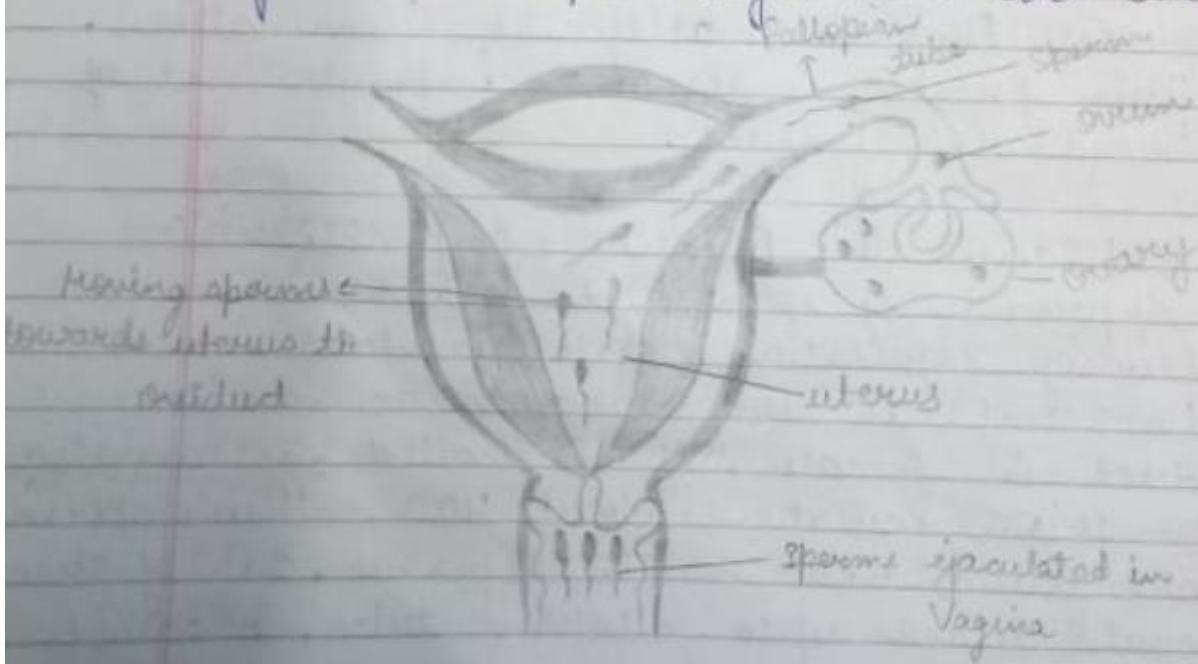
10. Define artificial insemination.  
When sperms are collected artificially, stored after preservation and fertilization is being done by inserting & liberating them in female's uterus, as needed, this process is known as artificial insemination. This process is used in improvement of breed in livestock.

11. Explain the process of fertilization.

1. Approach of sperms to ovum:

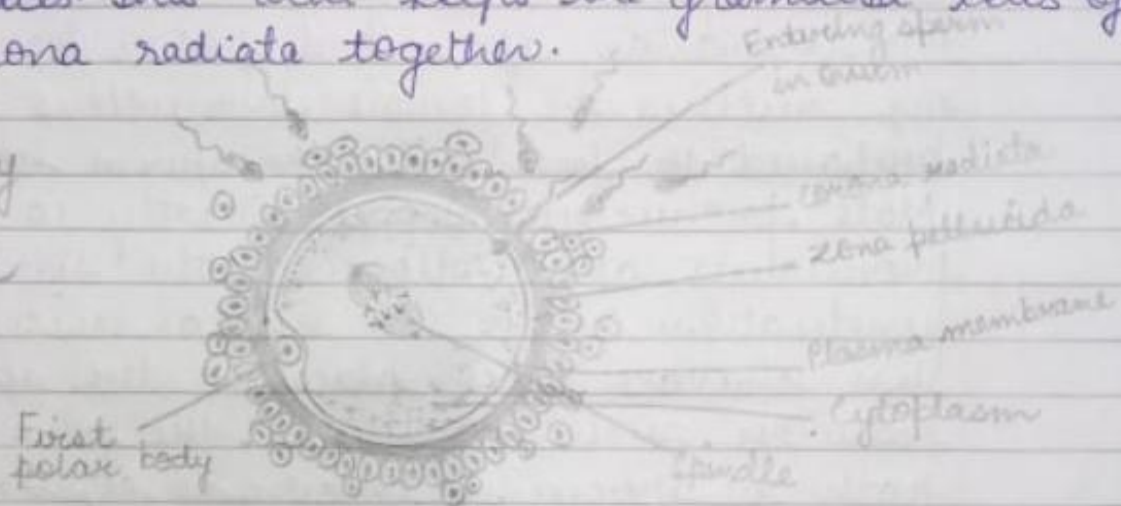
During copulation, male ejaculates semen (3-5 ml) in the vagina near uterian duct in female, it is called insemination. In this ejaculation about 400 million sperms are found. However, 100 sperms, out of these could reach upto fallopian tube, because

many sperms die due to acidity of the female genital duct. Several sperms are ingested by the phagocytes of vaginal epithelium. Sperms swim in the seminal fluid at the rate of 1-4 mm per minute. This movement of sperms is due to the uterian contraction process and peristaltic movement of the fallopian tube. The sperms become capable of fertilization after sometime since entering female uterus. The capability of fertilizing an ovum of its own species is known as sperm's capacitation. In this process physiological maturation of sperm takes place, in which due to the activity of lysigenous enzyme sperm enters the ovum by piercing the egg covering. This process takes about 5-10 hrs. After that sperm, fertilizes the ovum.



2. **Entry of sperm:** The ovum secretes a chemical substance which is called fertilizin. There are sperm's effeminate spots, where specific sperm with its antifertilizing site gets attached. By this fertilizin-antifertilizin reaction, ovum and sperm agglutinate together. Sperm lysins are acidic proteins. In these, one of the lysinogenic enzyme is hyaluronidase, which dissolves polymers of hyaluronidic acid present in intercellular spaces. This acid keeps the granulosa cells of corona radiata together.

Fig:  
Entry  
of  
Sperm  
in  
Ovum



3. **Cortical reaction:** Just after entry of sperm cortical reaction takes place in which the cortical granules present below the plasmalemma of ovum form chemical substances in between the cytoplasm of the ovum and vitelline membrane. After the entry of sperm into the ovum following metabolic activities takes place:

1. A fertilization cone is formed on the surface of the ovum.

2. Vitelline membrane changes into fertilization of membrane.
3. Movement is found in the cytoplasm.
4. Permeability of plasmalemma increases.
5. The rate of protein synthesis increases.
6. Mitotic division begins.

4. **Fusion of Pronuclei**: The entry of sperm in an ovum acts as stimulus. After the entry, of sperm in ovum the head and middle piece reach forward to head. With the formation of second polar body, the egg nucleus or female pronucleus gets prepared to fuse with the sperm head nucleus. Male pronucleus moves directly to female pronucleus after following the sperm penetration path. In several circumstances less changes takes place in the sperm path. In such conditions, the part of the path of sperm is known as copulation path.

7. **What is activation of Ovum?**  
**Activation of Ovum**: It is a series of processes that occur in the oocyte during fertilization. Sperm entry occurs causes release into the oocyte. In mammals, this has been proposed to be caused by the introduction of PLC $\alpha$  from the sperm cytoplasm, although this remains to be established definitely.



DATE: / /

Activation of ovum includes the following events:

- Cortical reactions.
- Activation of egg metabolism.
- Reactivation of meiosis.