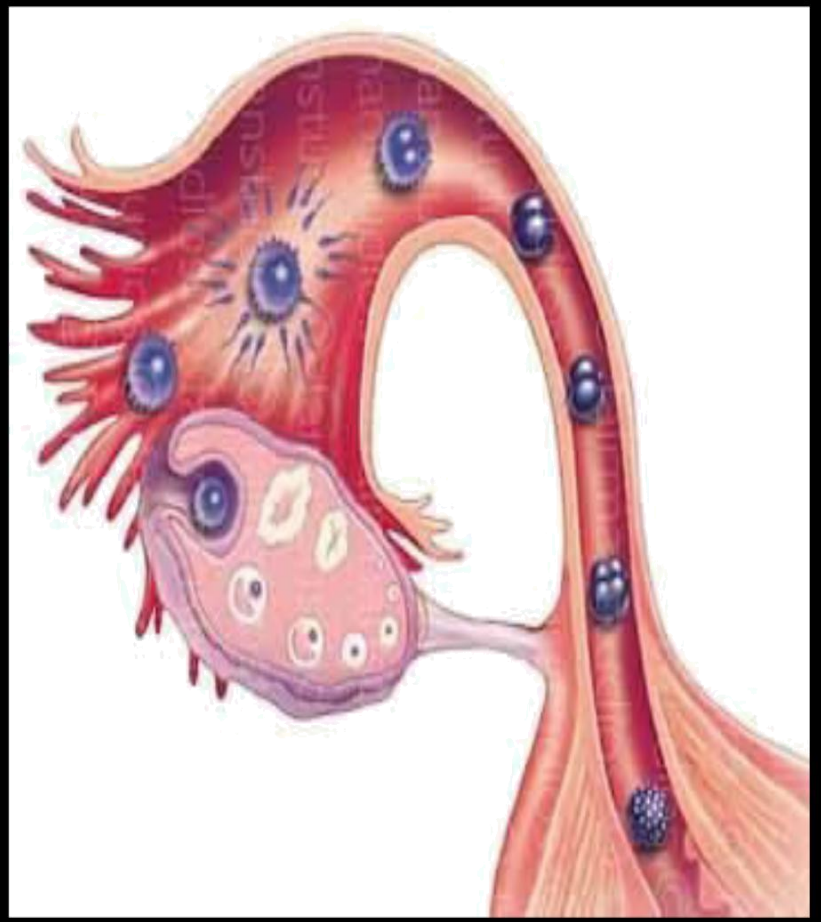
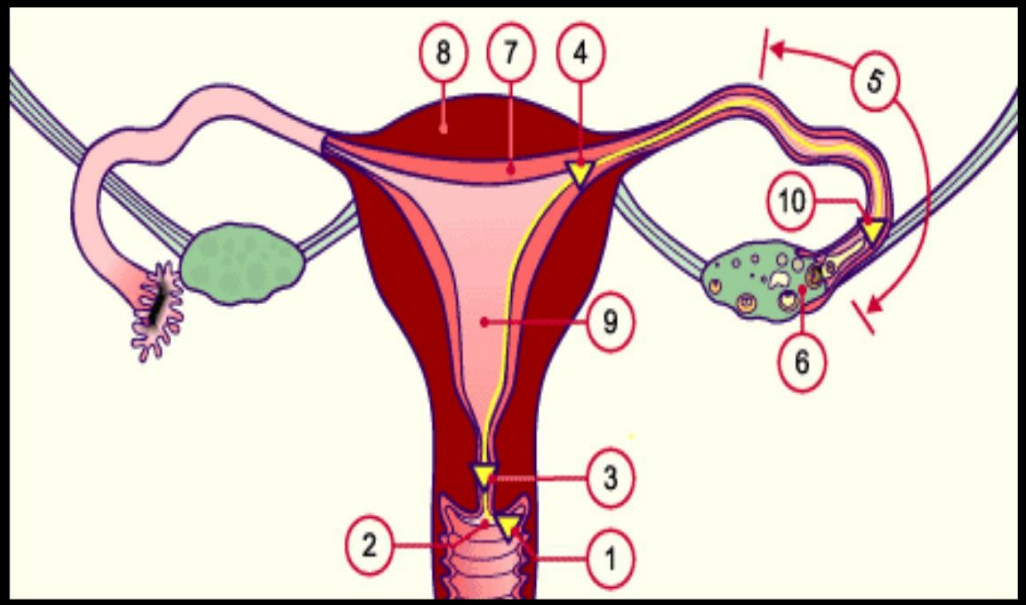
FERTILIZATION

Fertilization is the process by which fusion of male and female gametes occurs in the ampullary region of the uterine tube.



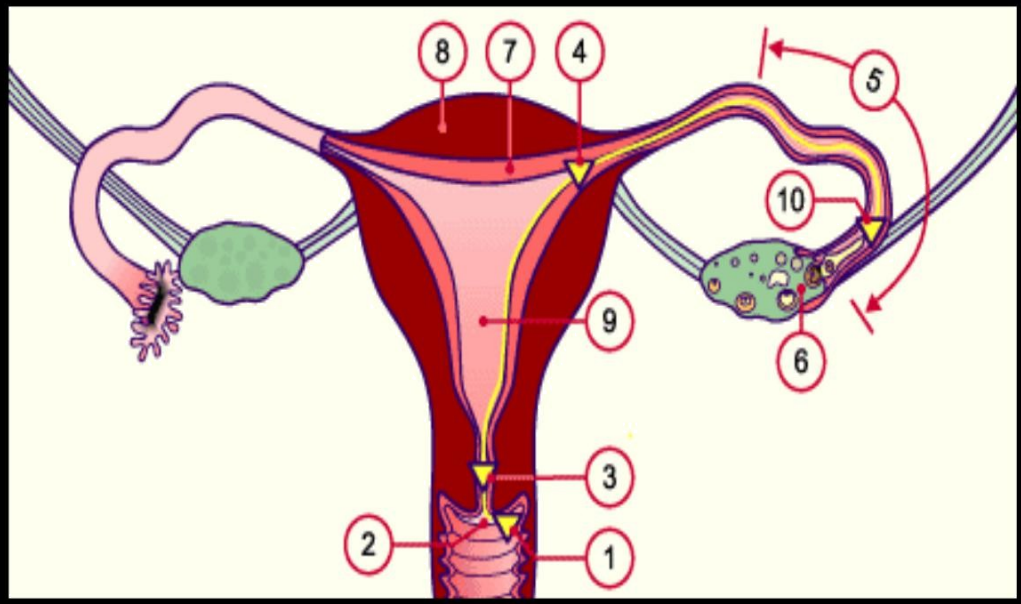
- Only 1% of the sperms deposited in the vagina enter the cervix.
- Movement of sperm from cervix to uterine tube occurs by muscular contractions of uterus and uterine tube & by their own propulsion.



The path the sperm cells travel is marked in yellow. The triangles indicate those places along the path where it has been shown that the sperm cells

Cont...

- 2-7 hrs to reach the uterine tube.
- On reaching the isthmus they become less motile and cease their migration.
- At ovulation, sperms become motile again- chemoattractants released by cumulus cells

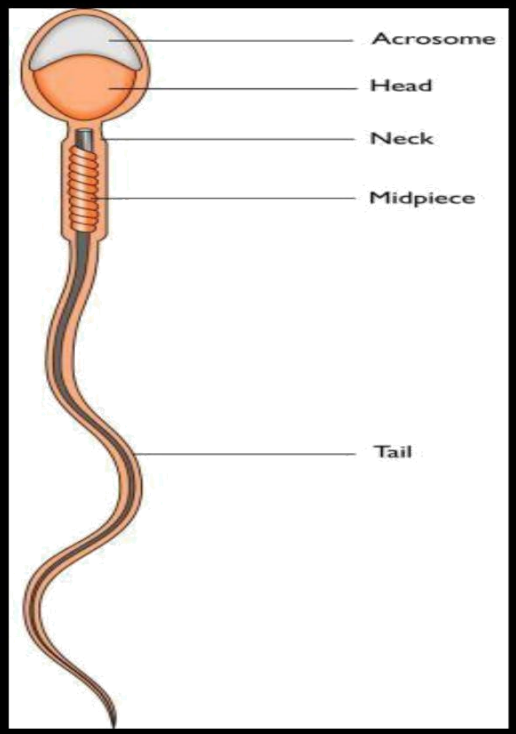


SPERMATOZOA must undergo:

1. Capacitation
2. Acrosome reaction

CAPACITATION: READYING THE SPERM

- Period of conditioning in the female reproductive tract (7 hrs in humans).
- Epithelial interactions b/w mucosal surface of tube (fertilizin) and sperm (antifertilizin)
- Glycoprotein coat & seminal plasma proteins are removed from the plasma membrane that overlies the acrosomal

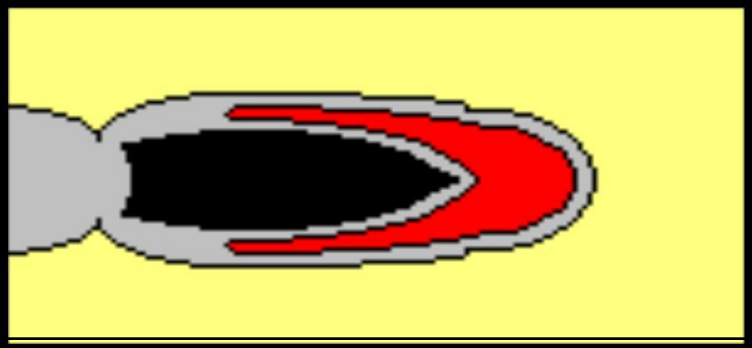


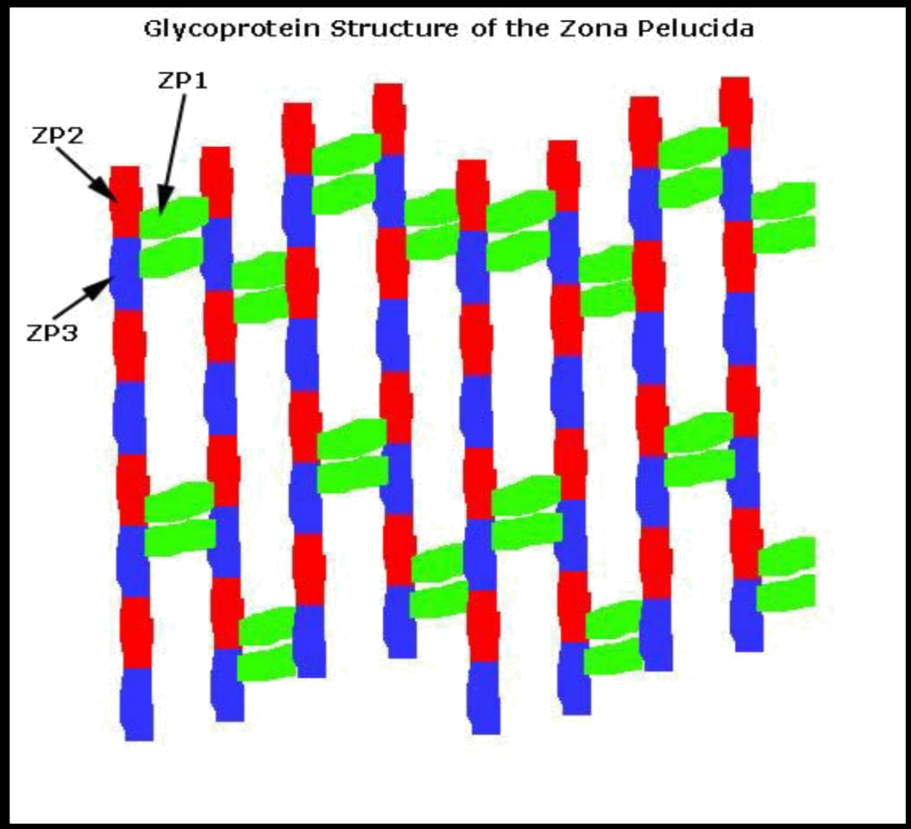
- Only Capacitated sperm is more active, undergoes chemotaxis & can

ACROSOME REACTION

Occurs after zona binding
Zona proteins: ZP1, ZP2, ZP3

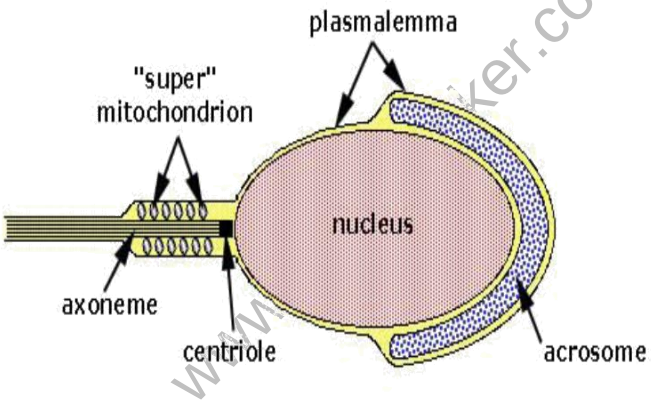
Sperm specifically binds to ZP3 glycoprotein
Initiates acrosome reaction





ACROSOME REACTION

1



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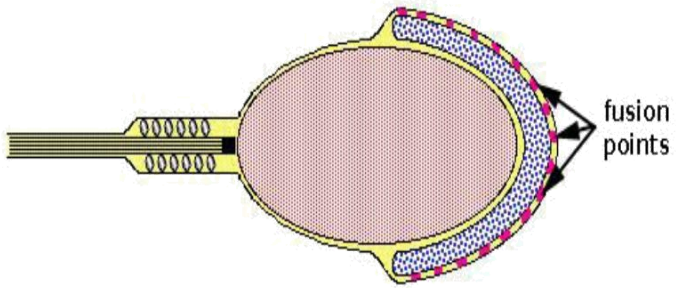

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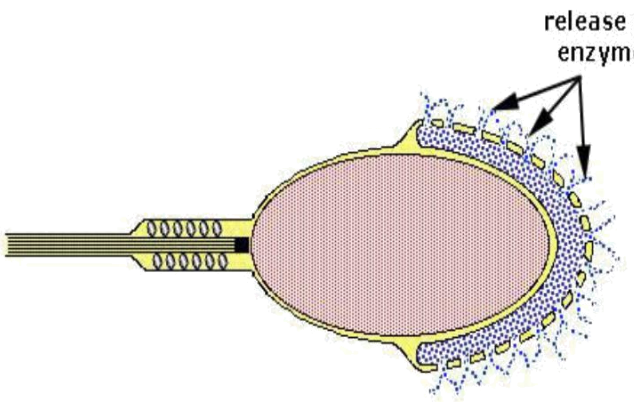

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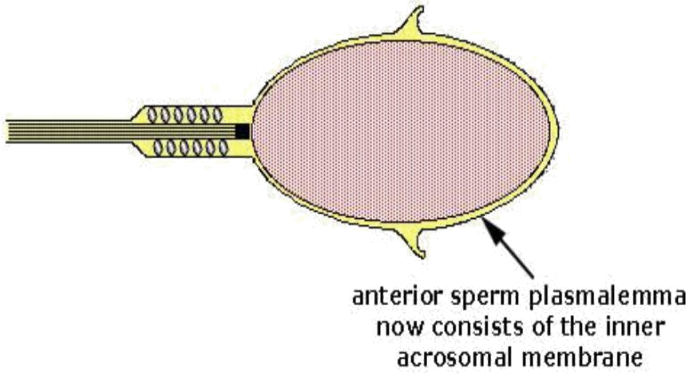


PROCESS OF FERTILIZATION

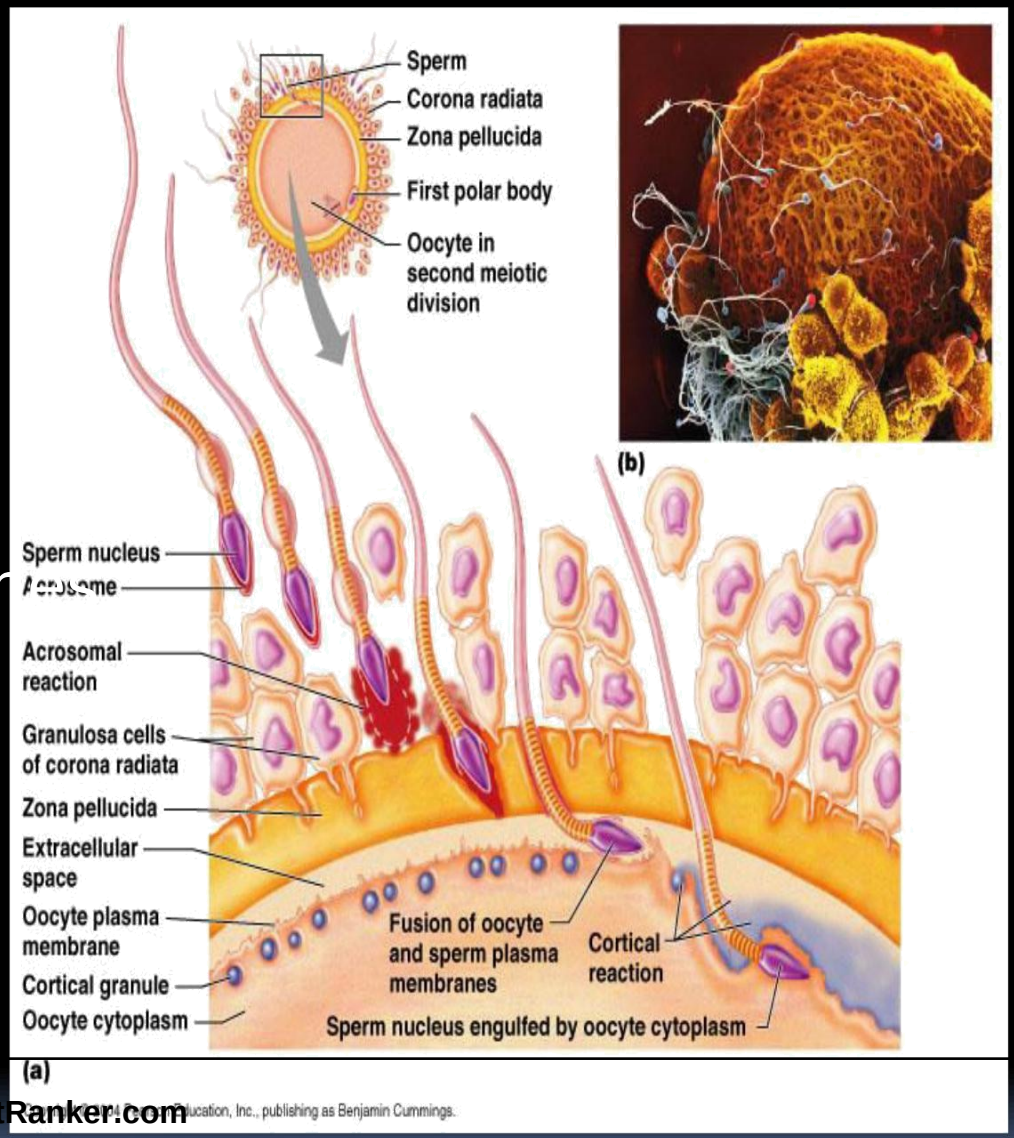
- Phase I: Penetration of Corona Radiata.
- Phase II: Penetration of Zona pellucida
- Phase III: Fusion of Oocyte and sperm cell membranes.

PHASE 1:PENETRATION OF CORONA RADIATA

- Passage of sperm through the corona radiata depends on enzyme action:
  - Acrosin & trypsin released from sperm acrosome
  - Tubal mucosal enzymes
  - Flagella action
- Ejaculation 200-300 million sperm, 300 to 500 reach the

PHASE 2:PENETRATION OF THE ZONA PELLUCIDA

- Zona is a glycoprotein shell that maintains sperm binding mediated by ZP3 that induces the acrosome reaction.
- Release of acrosomal enzym
- Penetration of ZP & contact with oocyte plasma membrane.
- Permeability of ZP changes on contact
  - Cortical reaction



PHASE 3:FUSION OF OOCYTE & SPERM PLASMA MEMBRANES

- For initial adhesion interaction of integrins on Oocyte & their ligands, disintegrins on sperm.
- After adhesion, fusion of plasma membranes occur
- Actual fusion is accomplished between the plasma membranes of the oocyte and the membrane that covers the posterior region of sperm head

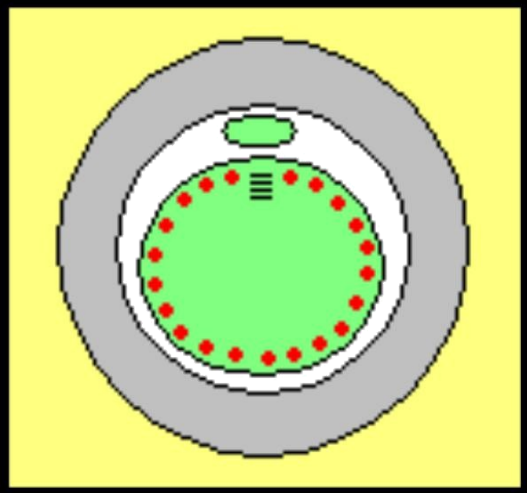
- ✓ **Both Head and tail of a sperm**

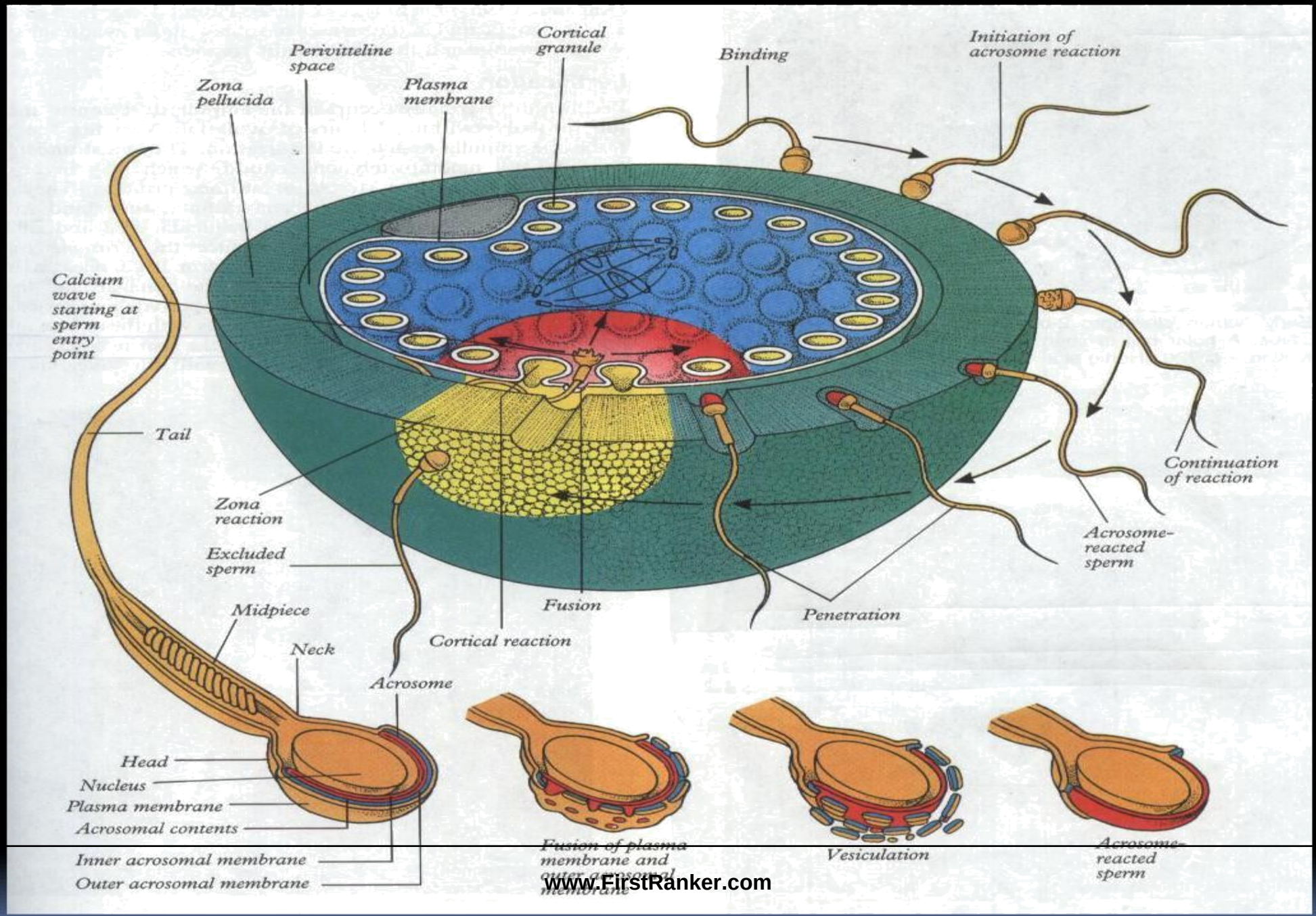
THE EGG RESPONDS IN THREE WAYS:

1. **CORTICAL & ZONA REACTIONS**
2. **RESUMPTION OF 2ND MEIOTIC DIVISION OF OOCYTE**
3. **METABOLIC ACTIVATION OF EGG**

1.CORTICAL REACTION

- Refers to a massive exocytosis of cortical granules lining the plasma membrane of oocyte seen shortly after sperm-oocyte fusion.
- Cortical granules contain a mixture of enzymes, including several proteases, which diffuse into the zona pellucida following exocytosis from the egg. These proteases alter the structure of the zona pellucida, inducing the zona reaction.



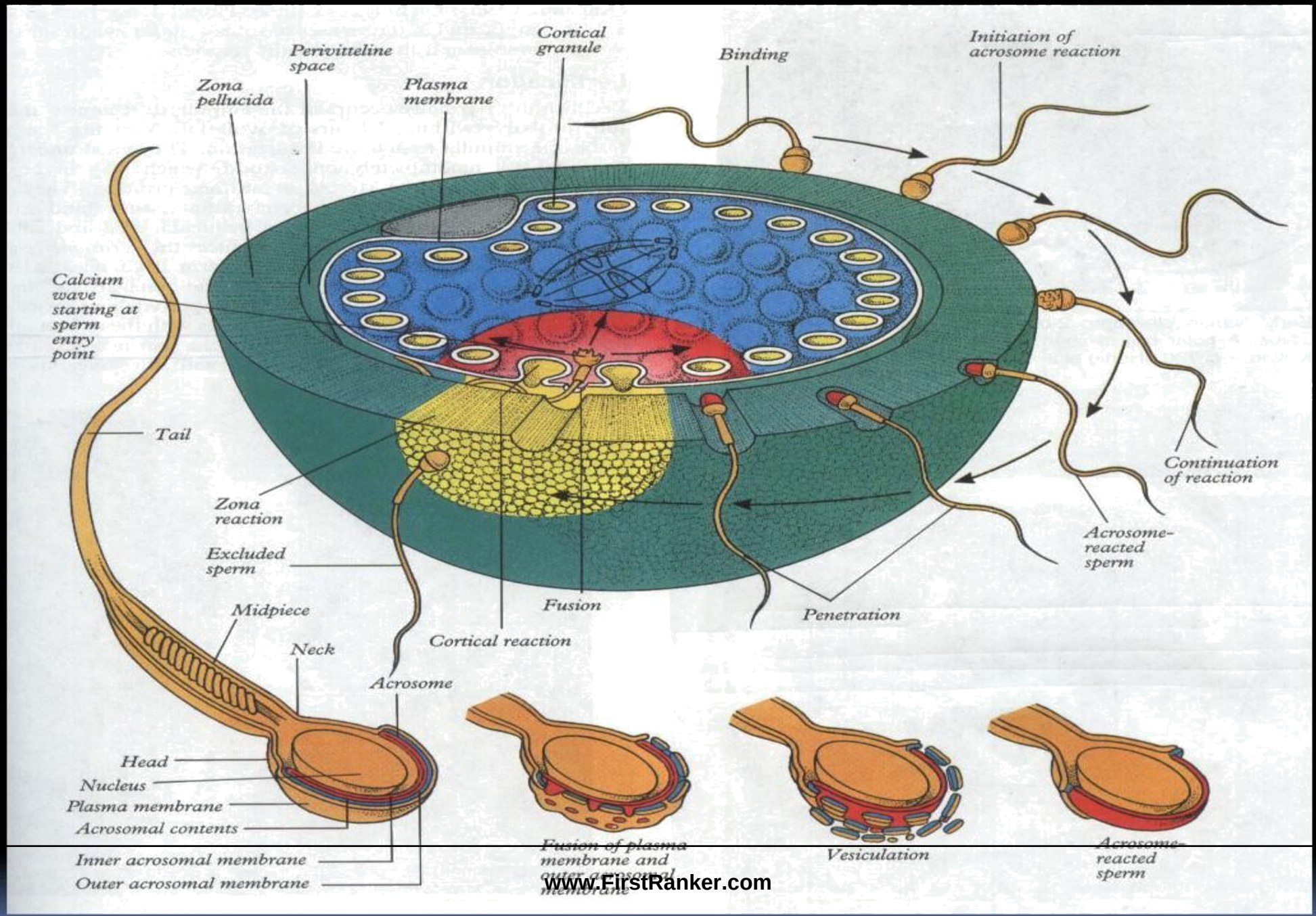


2.ZONA REACTIONS

- The zona reaction refers to an alteration in the structure & composition of the zona pellucida catalyzed by proteases from cortical granules.
- Sperm receptors in the zona pellucida are

  destroyed to prevent sperm binding and penetration

- These reactions prevents polyspermy



2. RESUMPTION OF 2ND MEIOTIC DIVISION OF OOCYTE

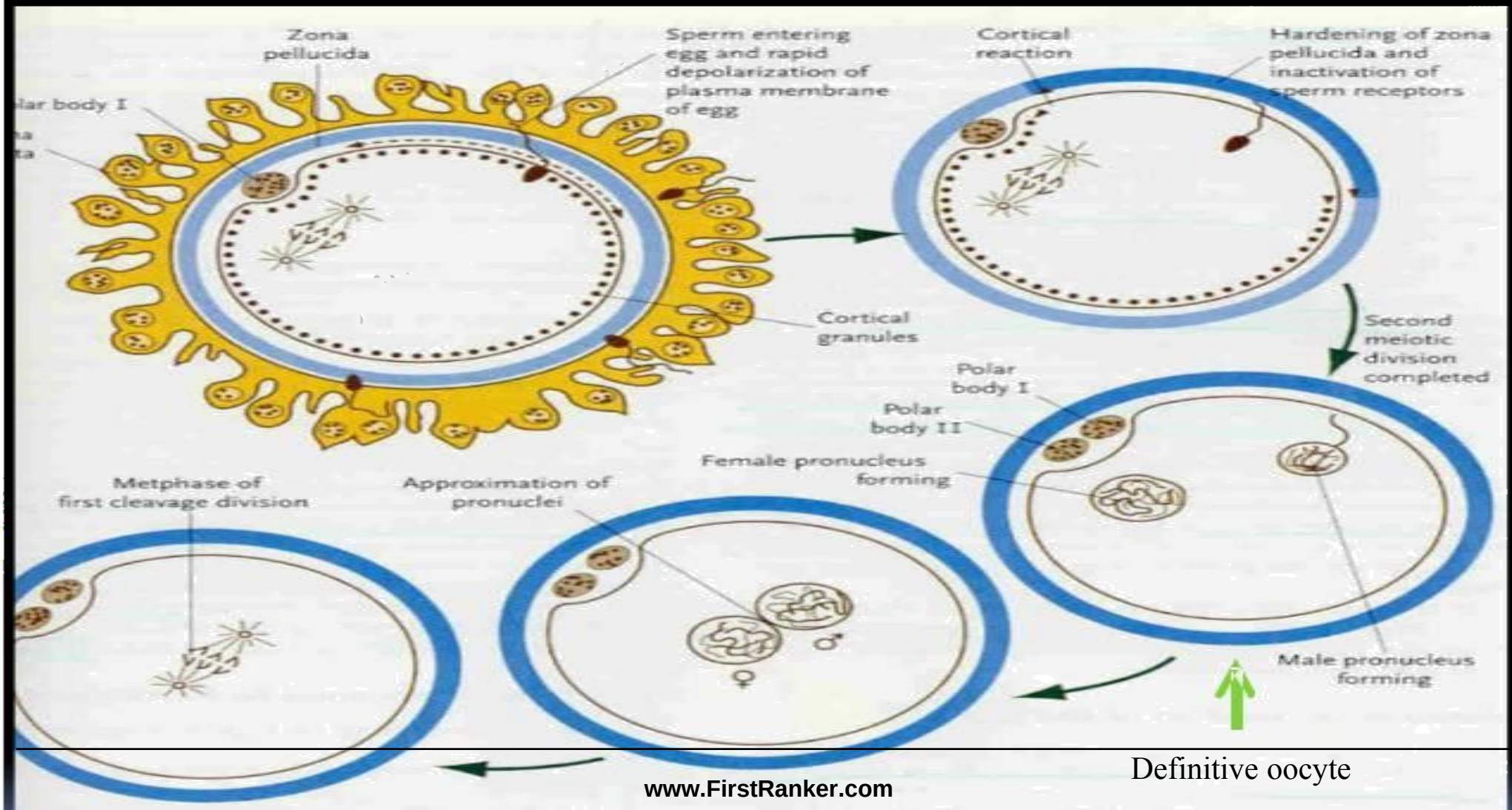
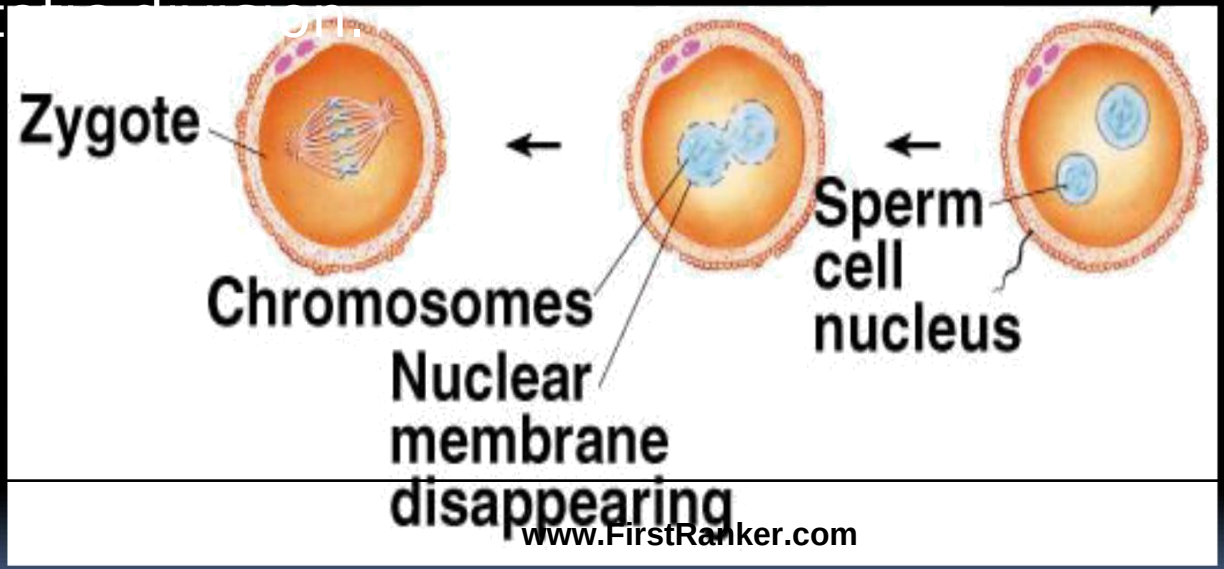


Figure 2-6 Summary of the main events involved in fertilization

3.METABOLIC ACTIVATION OF EGG

- **Activating factor is carried by spermatozoon**
- Formation of male pronucleus
- Tail detaches and degenerates
- At this stage, the male and female pronuclei are indistinguishable.
- The two pronuclei fuse eventually, loose nuclear envelops .
- During growth of male and female pronuclei (both haploid) each replicates its DNA and then undergo first mit[illegible]



CONSEQUENCES OF FERTILIZATION

- Stimulates the secondary oocyte to **complete meiosis II**.
- **Restores the normal diploid number** of chromosomes (46).
- Results in **variation** of human species as maternal and paternal chromosomes intermingle.
- The embryo contains only **maternal mitochondria** because the sperm mitochondria

the sex

- Initiation of cleavage: Without fertilization oocyte degenerates in 24hrs