IVth paper

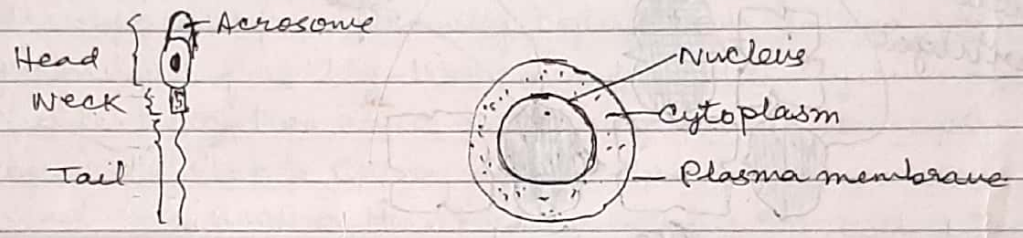
FERTILIZATION

The fusion of male and female gametes to form a zygote is called fertilization. Fertilization bring together maternal and paternal chromosomes and this restore the diploid number of chromosomes. The sequence of change during fertilization includes Karyosomy (fusion of nuclei) followed by Plasmogamy (i.e. mixing of cytoplasm of the two gametes).

Fertilization may be classified as:

i) External fertilization : Fertilization takes place outside the bodies of male and female. Ex- Fish, frog etc.

ii) Internal fertilization : Fertilization takes place inside the body females Ex. Reptiles, birds, mammals.



A sperm

Fertilization further may be:

i) Monospermy: usually one sperm enter into the single ovum. Ex- mammals, frog, coelentrate.

ii) Polyspermy :- Some times more than one sperm enter into single ovum but only one sperm make contact with ovum nucleus while rest dissolved in cytoplasm eg. Mollusc, reptiles, birds.

② Stages of maturation of the egg at fertilization:-

Fertilization may takes place at different stages of maturation of eggs.

ⓐ When eggs are fully mature:

In Sea urchin fertilization takes place of the fully matured egg, with both polar bodies formed. Immediately after the entery of sperm, the two pronucleus of male and female ovum gamete fused to form a fusion nucleus. Ex- Sea-urchin

ii) Entery of sperm into immature eggs:

In such animal (eg. Ascaris) the egg is immature at the time of sperm entery with no

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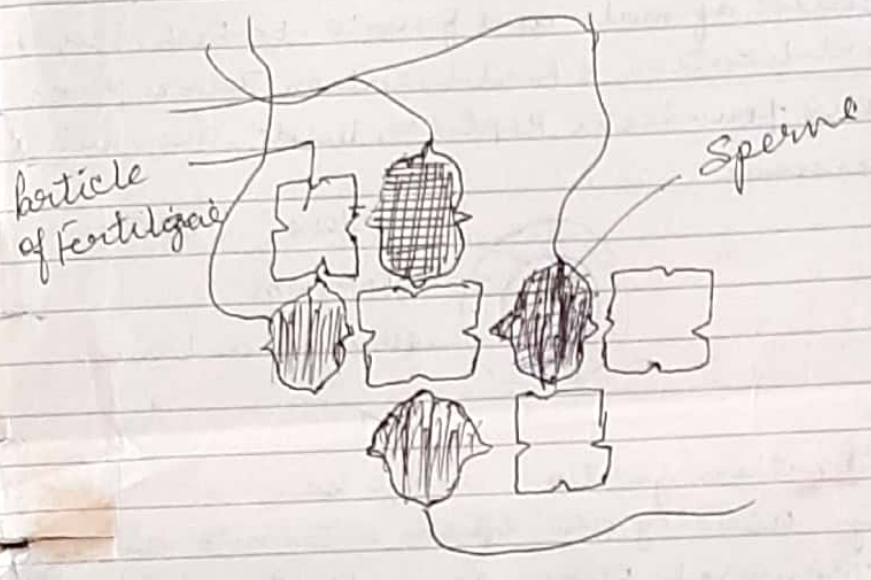
polar bodies formed. The sperm nucleus has to wait in the cytoplasm of ovum until both the divisions have been completed.

iii) Intermediate Stage:

In amphioxus and most chordates the sperm enters into the secondary oocyte stage, after the formation of first polar body.



Process of Fertilization:

The whole process of fertilization may be described under following three heads.

① Movements of Sperm towards ovum:

The movement of sperms become essential to reach the non-motile ovum. This is done by the sperms with the help of its tail by whip like lashing movement. This movement is initiated by attraction caused by a glucoprotein substance known as fertilizin secreted by matured egg. The fertilizin also help to stick the sperm with the surface of egg. Fertilizin is a glucoprotein and checked the polyspermy. The sperm has chemical on his head called antifertilizin. This antifertilizin is an acidic protein

which combines with fertilizin in a specific manner.

ii) Penetration of sperm into the ovum.

The acrosome of sperm produced an enzyme called hyaluronic acid (sperm lysin). Sperm lysin is different in different species. The hyaluronic acid breaks mucopolysaccharides of cell membrane of follicle cells of eggs. Thus the penetration of sperm into the ovum is a bio-chemical process. Some eggs may have a micropyle for the entery of sperm. The tip of acrosome touches the egg membrane and begins the egg reaction. As the acrosome touches the egg surface, the egg cytoplasm bulged forward forming a fertilization cone from the hyaline cytoplasm. The fertilization cone gradually engulf the sperm and begins to recede carrying the sperm inward. Only the head and neck of the sperm enter the egg, the tail left out.

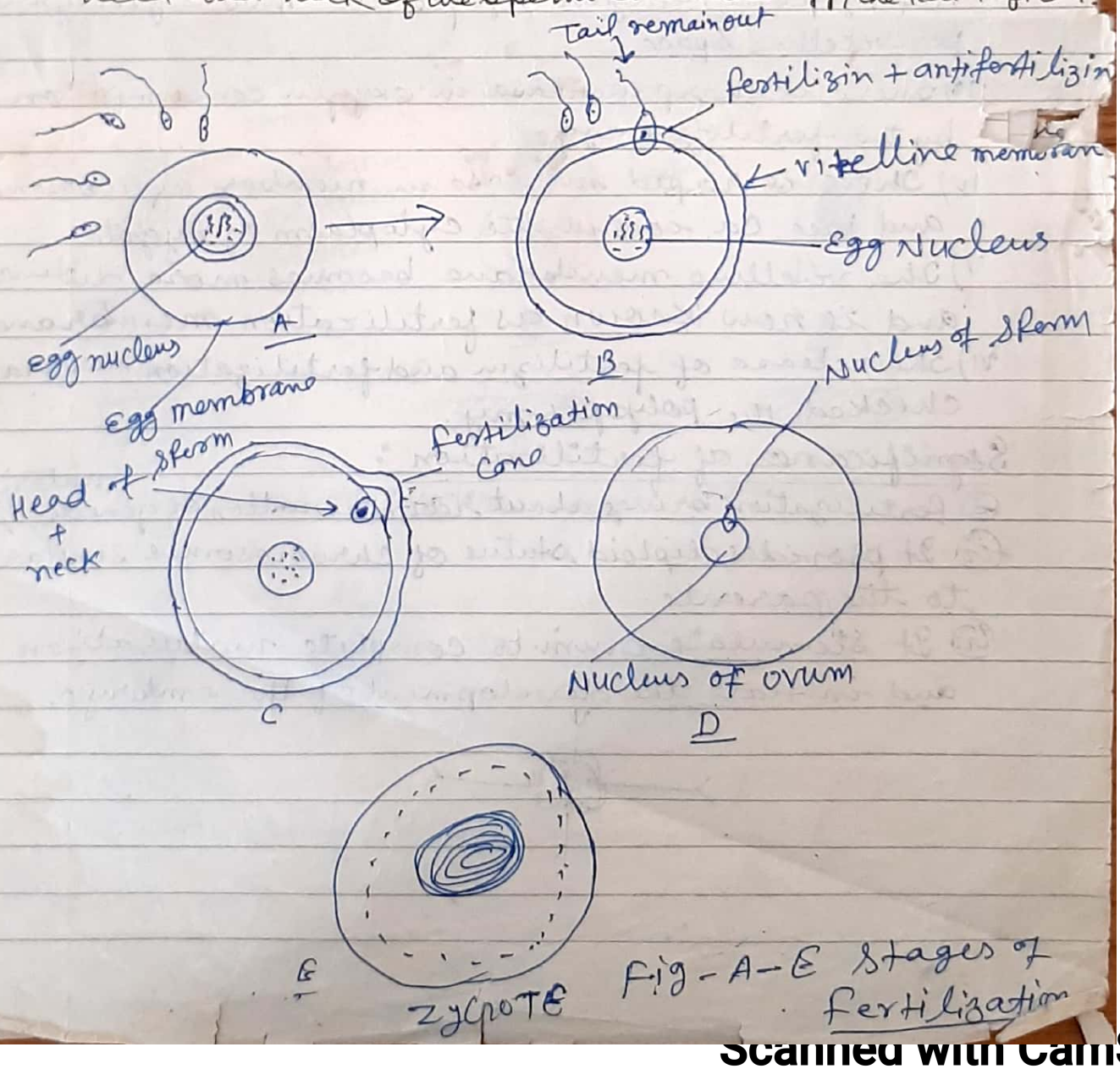


Fig - A - E Stages of fertilization

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iii) Fusion of gametic nuclei : When the sperm enter the o
its nucleus is separated from rest parts. This separated nucleus is now known as male pronucleus. The male pronucleus now moves the female pronucleus. The two pronuclei fuse resulting in the formation of diploid zygote. The rest part of the sperm are absorbed in the cytoplasm of the ovum.

Changes after fertilization : Many rapid changes takes place after fertilization.

(i) The cytoplasmic mass of the ovum shrinks and the vitelline membrane rises above the surface. As a result of which perivitelline space present between the vitelline membrane and the plasma membrane increases in width.

ii) There is rapid increase in permeability. water K^+, PO_4^-, glycerol, ethylene, glycol etc. moves freely into perivitelline space

(iii) There is sharp increase in oxygen consumption by the fertilized eggs.

iv) There is rapid increase in number of ribosomes and free Ca cons in the cytoplasm of zygote.

v) The vitelline membrane becomes more distinct and is now known as fertilization membrane.

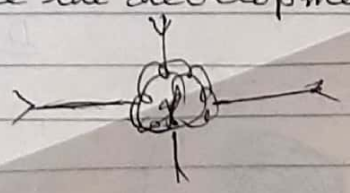
vi) The release of fertilizin and fertilization membrane checked the polyspermy.

Significance of fertilization :

(i) fertilization brings about recombination of genetic material.

(ii) It provides diploid status of chromosomes similar to the parents.

(iii) It stimulate ovum to complete maturation and initiate the development of the embryo.



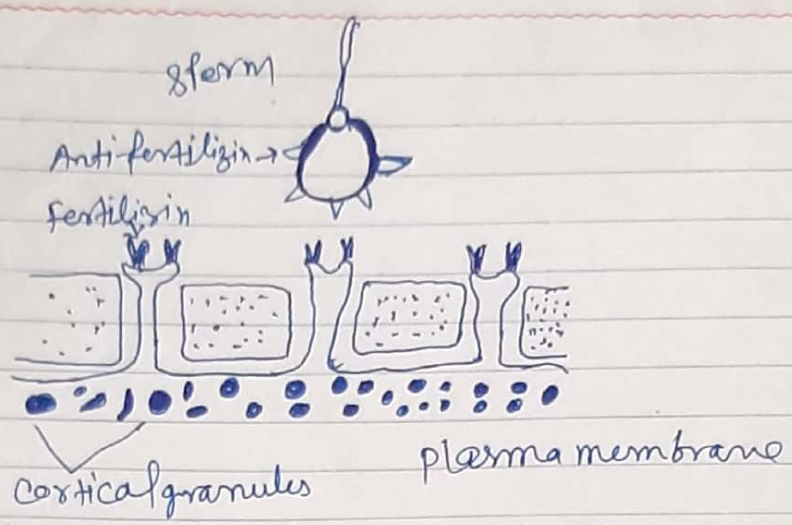


fig1- fertilizine of egg & antifertilizin of sperm

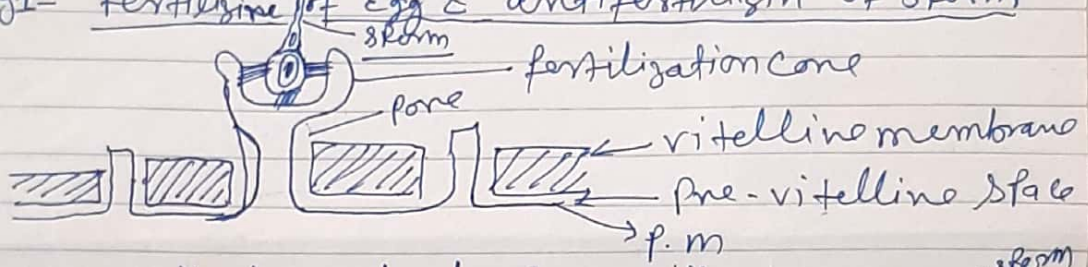
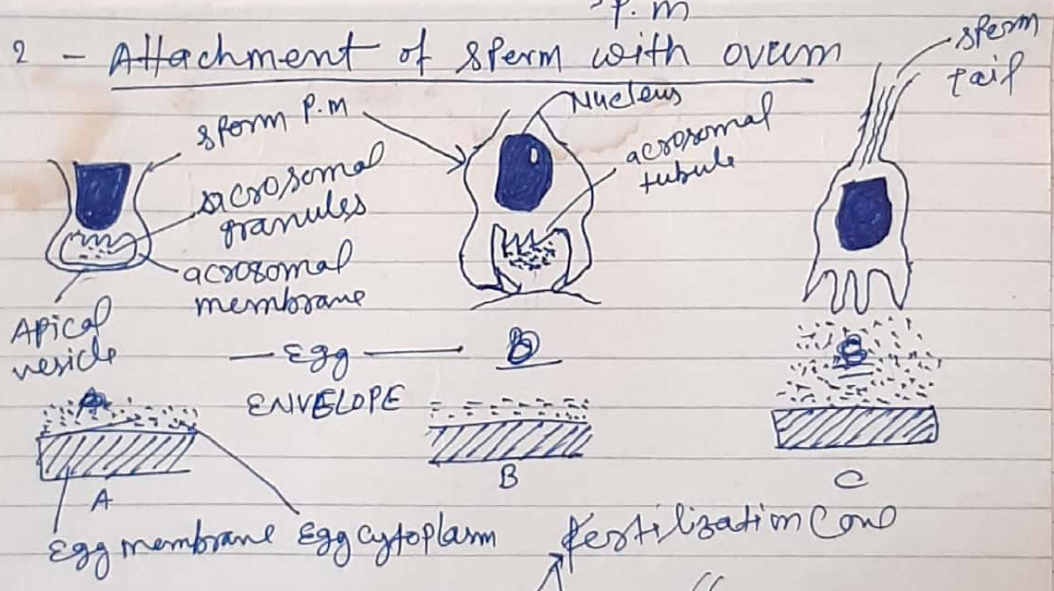


fig-2 - Attachment of sperm with ovum



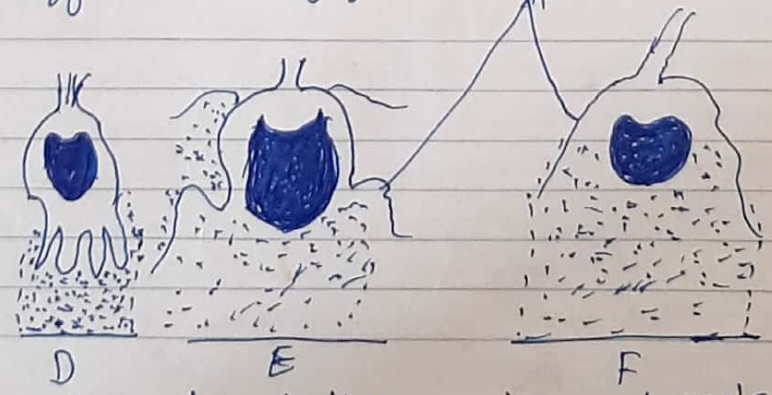


fig:- Events in the union of male & female gametes

fertil.