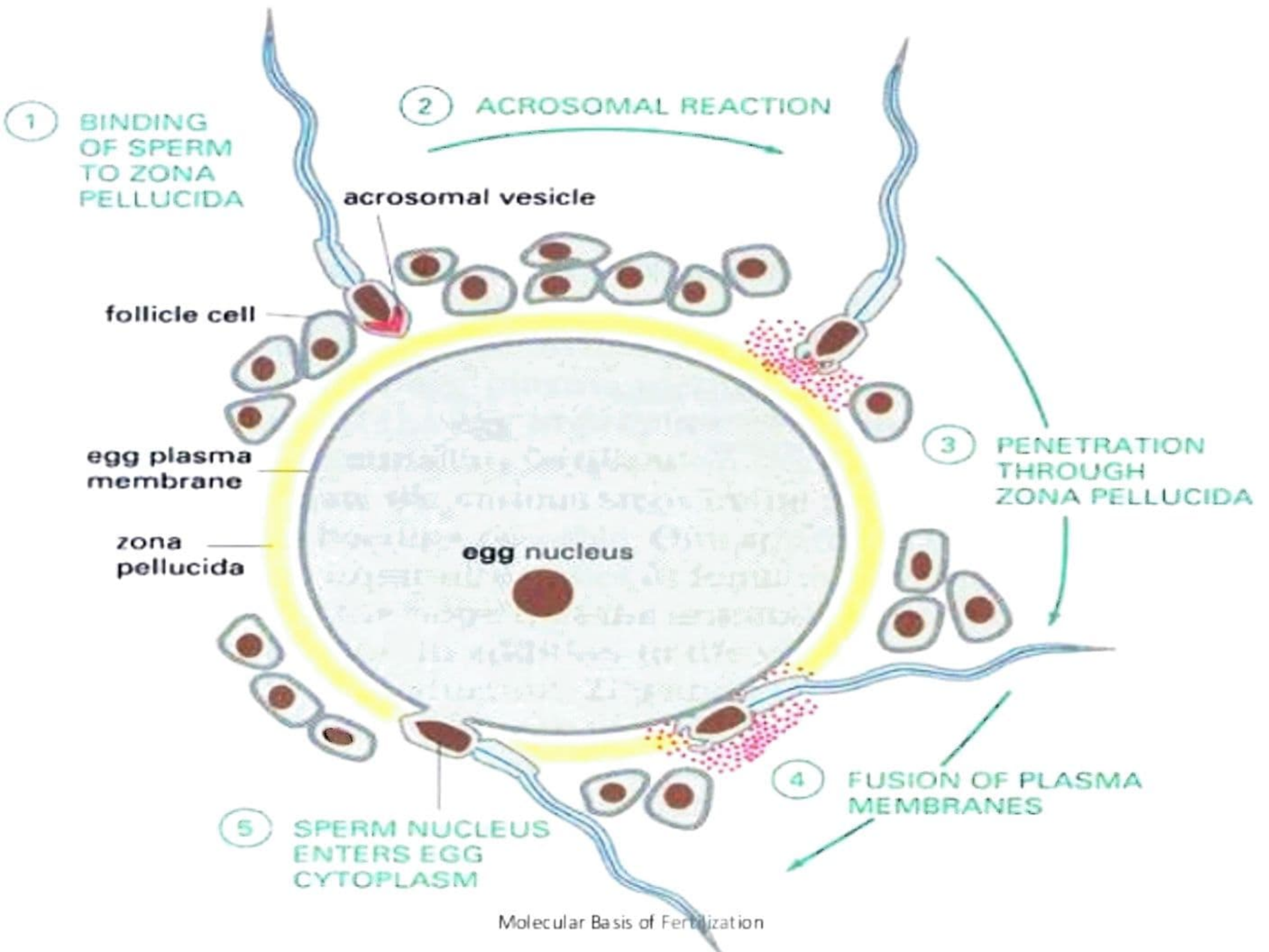
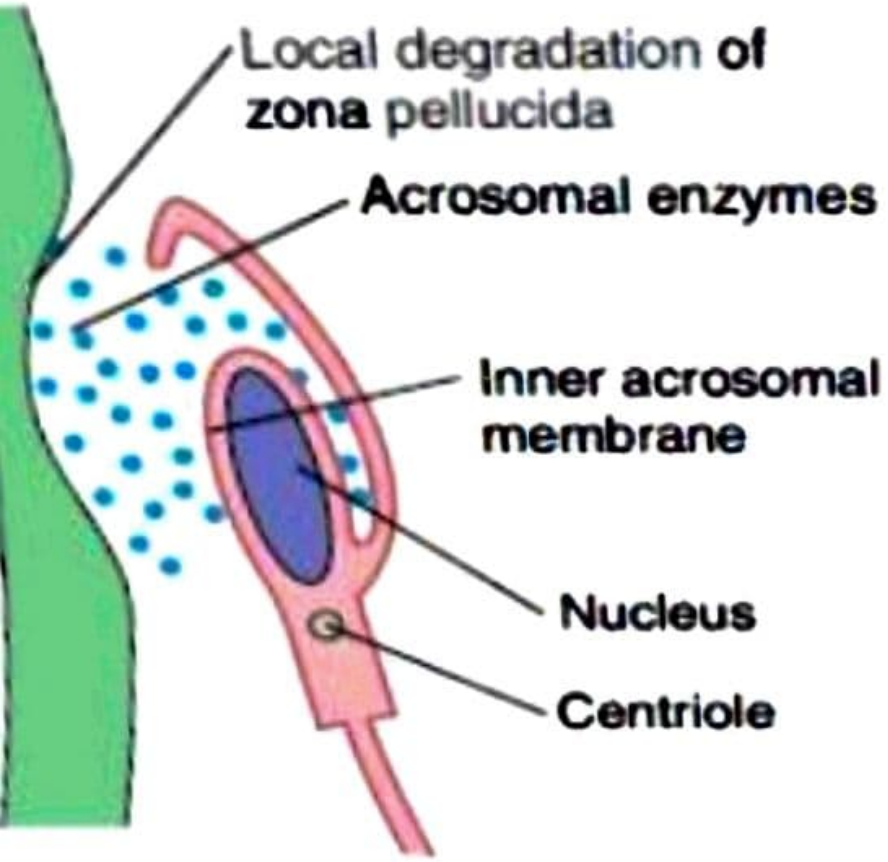
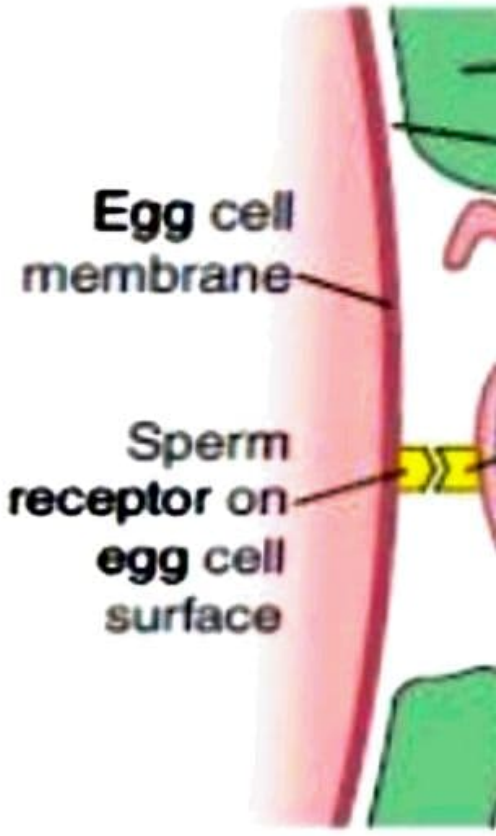
C. Nuclear Reaction

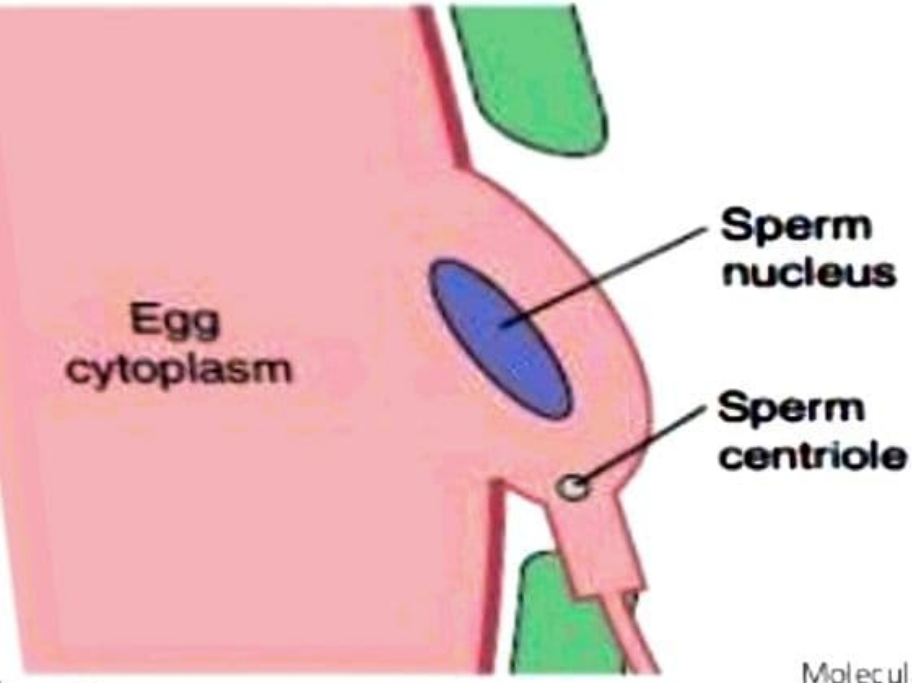
- Cortical reaction pulls the sperm nucleus.
- Loses the membrane that surround the head.
- Tail incorporated into the egg cytoplasm.
- Naked nucleus → male pronucleus
- Approaches haploid nucleus of the ovum → female pronucleus
- Male pronucleus + female pronucleus → diploid zygote
- GENOME of a NEW ORGANISM… mitotic process….


1 BINDING OF SPERM TO ZONA PELLUCIDA
2 ACROSOMAL REACTION
acrosomal vesicle
follicle cell
egg plasma membrane
zona pellucida
egg nucleus
3 PENETRATION THROUGH ZONA PELLUCIDA
4 FUSION OF PLASMA MEMBRANES
5 SPERM NUCLEUS ENTERS EGG CYTOPLASM

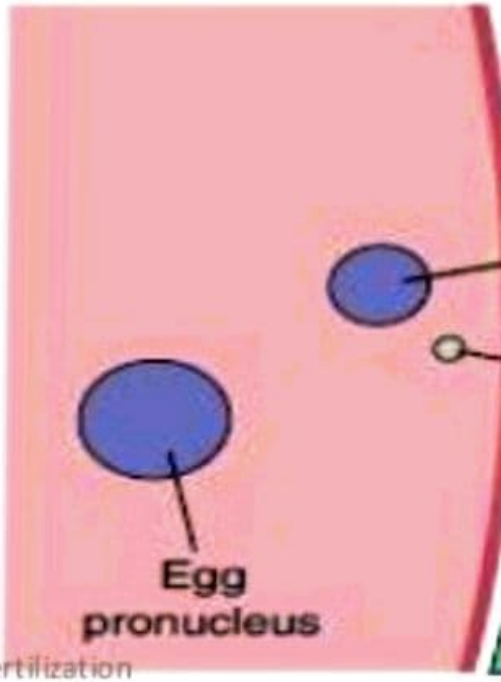

Local degradation of zona pellucida
Acrosomal enzymes
Inner acrosomal membrane
Nucleus
Centriole


Egg cell membrane
Sperm receptor on egg cell surface

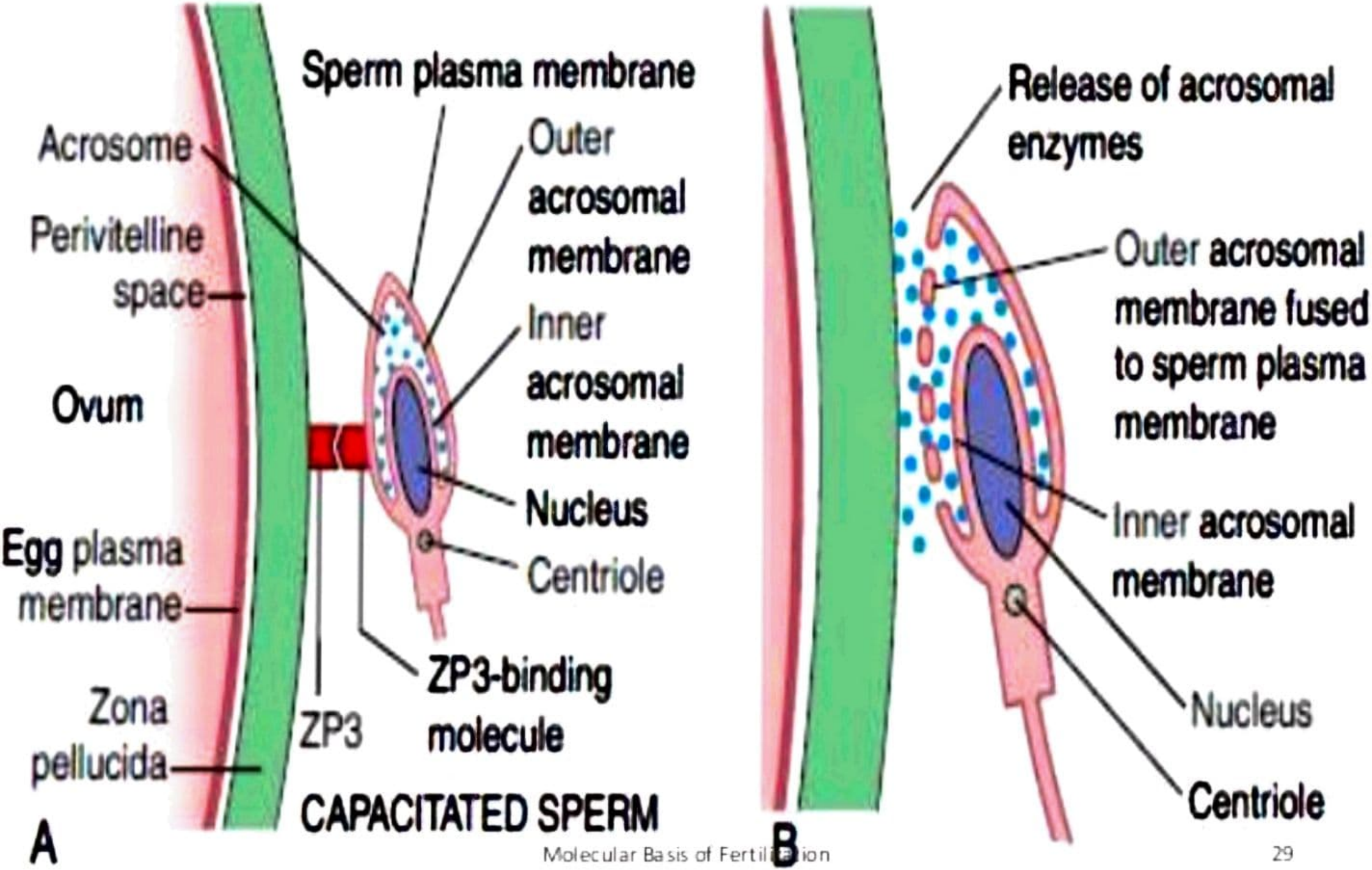
D

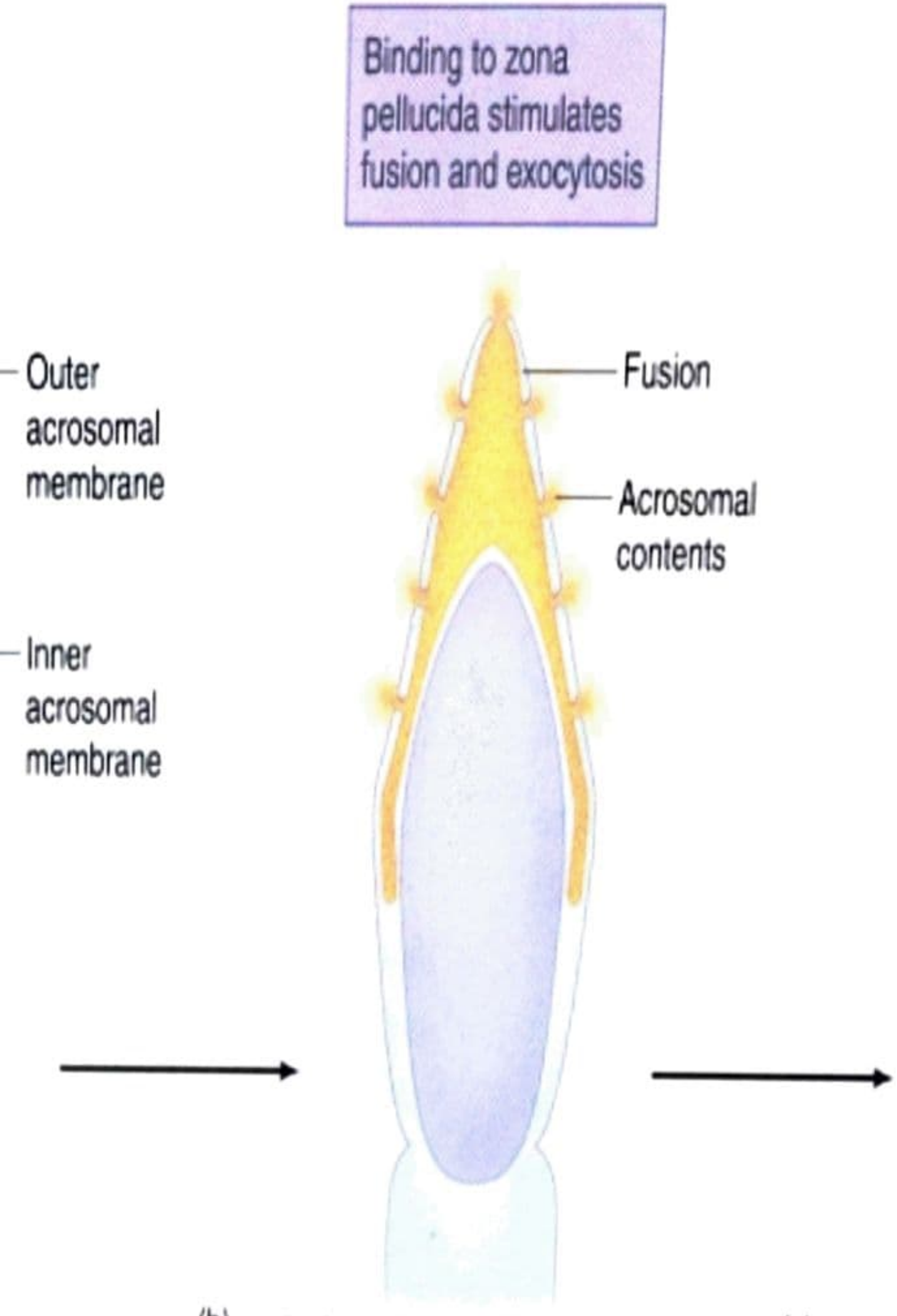

Egg cytoplasm
Sperm nucleus
Sperm centriole

E


Egg pronucleus

F


Sperm plasma membrane
Acrosome
Outer acrosomal membrane
Perivitelline space
Inner acrosomal membrane
Ovum
Nucleus
Centriole
Egg plasma membrane
ZP3-binding molecule
Zona pellucida
ZP3
CAPACITATED SPERM
A
Release of acrosomal enzymes
Outer acrosomal membrane fused to sperm plasma membrane
Inner acrosomal membrane
Nucleus
Centriole
B


Binding to zona pellucida stimulates fusion and exocytosis
Outer acrosomal membrane
Inner acrosomal membrane
Fusion
Acrosomal contents
(b)
Molecular Basis of Fertilization
(c)

↓

Influx of Ca^{2+} into the sperm cytosol

↓

Contents of the acrosome are released (+ exocytosis)

i. Proteinases/acrosin) + hyaluronidase → penetration of ZP.

ii. Exposes other proteins on the sperm surface that bind to ZP2 → help the sperm maintain the binding to zona

iii.Exposes a protein in the sperm plasma membrane that mediates the binding and fusion of this membrane with that of the egg.

- Penetration thru ZP → 15-25min.

Cont...

The acrosome reaction is associated with the release of acrosome enzymes that facilitate fertilization

Acrosomal enzymes: esterases, acrosin,hyaluronidase ,and neuraminidase cause lysis of the zona pellucida

- Zona Binding
- Zona proteins: ZP1, ZP2, ZP3

- Initiates acrosome reaction

a) Acrosomal Reaction

After binding to the corona radiata t
sperm reaches the zona pellucida.

Sperm head binds to a ZP2 glycoprotein in the zona pellucida.

This binding triggers the acrosome to burst, releasing enzymes that help the sperm get through the zona pellucida.

CONT....

Effects of Capacitation on Sperm

- Increased rate of metabolism
- Hyperactivation: flagellum beats more rapidly
- Changes in sperm glycoproteins allow sperm egg binding
- Pro-Acrosin (inactive) is converted to acrosin (active)

Changes in surface glycoproteins, caused by secretion of FGT

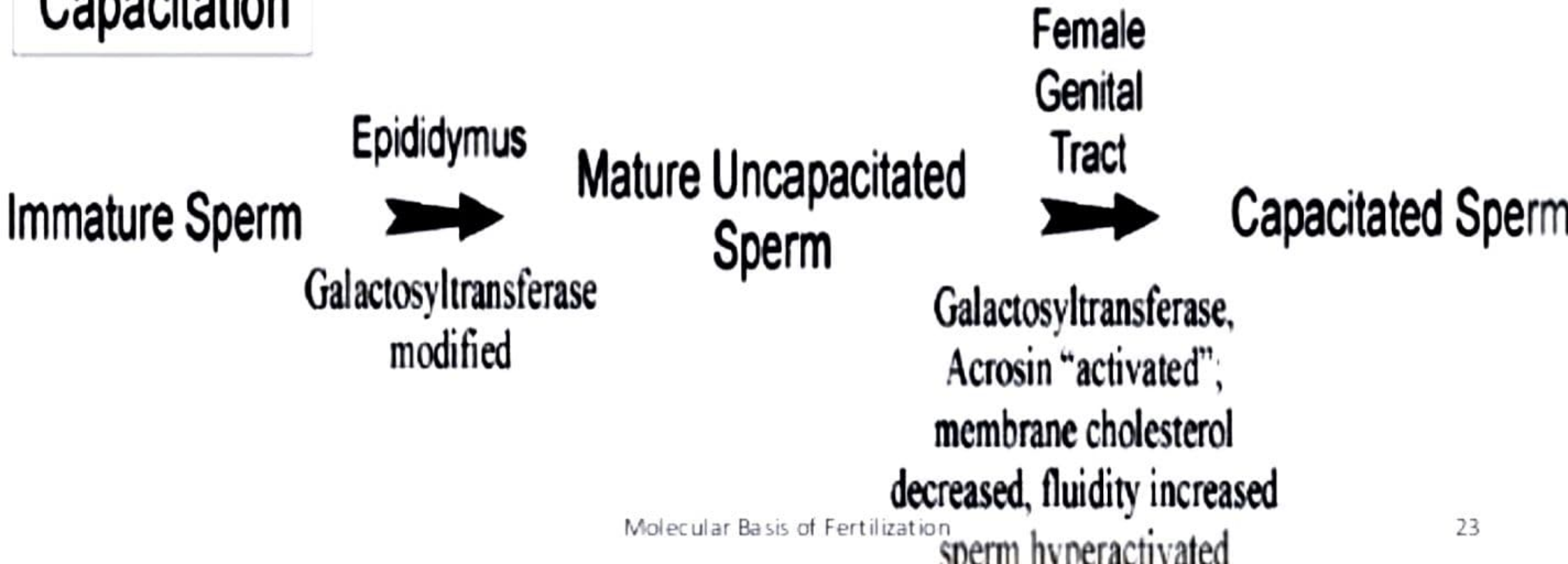
Cholesterol is removed- increase Fluidity

Glycoproteins are lost- expose zona binding proteins

Proteins are phosphorylated

Fluctuations occur in the intracellular levels of calcium ions- essential for hyperactivation.

Capacitation



b.Capacitation

- Sperms **cannot** fertilize oocytes when they are newly ejaculated. Thus Capacitation
- Is a process of sperm becoming fertile

- a process of essential changes in the spermatozoa that enables them to fertilize the egg.

- occurs during transport in female genital tract

- capacitated sperm have the ability to fertilize the egg

- The process of capacitation takes 5-7 hours.