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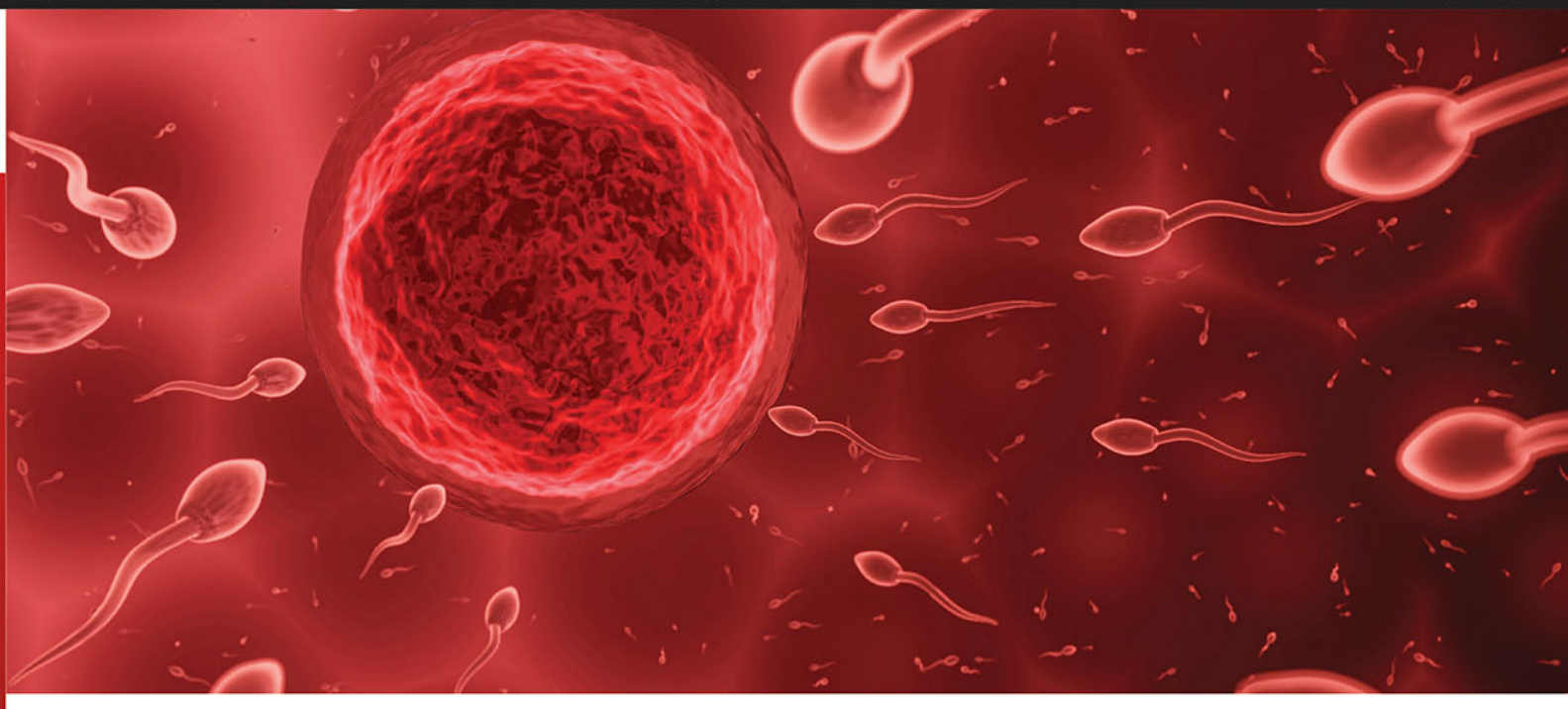

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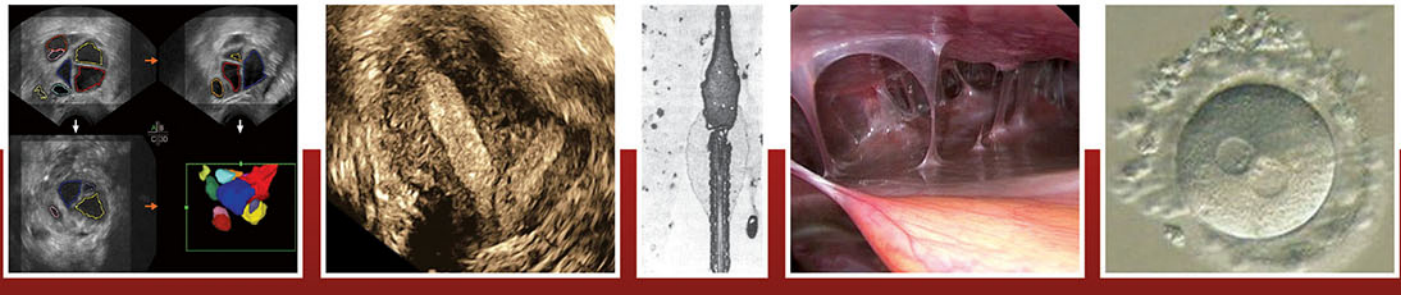

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Chapter 2

The Human Sperm and Egg: Key Players of Fertilization

Dorothy Dessa, Vyshnavi A Rao

Chapter Outline

- History
- Structure of Sperm Cell
- Structure of the Oocyte
- Maturation and Activation of Spermatozoa

INTRODUCTION

Structure of sperm cell: It contains head, acrosomal cap, neck, midpiece, and tail. Acrosome contains proteolytic enzymes.

Structure of oocyte: It is one of the largest cells in human body. It is covered by zona pellucida (ZP). ZP has specific receptors for sperm binding and prevents polyspermy.

Maturation and activation of spermatozoa—four stages have been described:

1. Storage in the epididymis—maturation
2. Ejaculation—activation of motility
3. Ascension through the female reproductive tract—capacitation
4. Near the oocyte—acrosome reaction

Oocyte maturation: It includes both nuclear and cytoplasmic maturation. Nuclear maturation is evident by extrusion of first polar body.

Fertilization: Oocyte activation occurs following invasion by spermatozoa. Polyspermy is prevented by transient block due to membrane depolarization followed by permanent block due to cortical reaction. Fertilization is recognized by the appearance of two pronuclei (male and female) with the extrusion of the second polar body.

Impact of intracytoplasmic sperm injection (ICSI) on fertilization: Nuclear decondensation may be slower due to presence of acrosomal materials, but male pronuclear formation is not hindered.

Fertilization is a fascinating process that leads to the recreation of an entire being from the fusion of a single sperm and egg.

HISTORY

- *Leewenhoek (1677):* First saw sperm under microscope and called them "little animals of semen."
- *Von Baer (early 19th century):* First saw mammalian egg under microscope.
- *Oscar Hertwig (1876):* First discovered the fusion of sperm and egg nuclei during fertilization in sea urchins.[1]

STRUCTURE OF SPERM CELL

- The sperm is a small, compact, highly specialized cell for the function of fertilizing an egg.
- It consists of head, neck, midpiece, and tail; all bounded by a single, continuous plasma membrane.
- Head is oval shaped 4–5 μm long, 2–3 μm wide, and 1.5 μm thick with a smooth outline **(Figs. 1A to C)**.
- Head is covered by acrosomal cap (40–70% of head area). Acrosome contains proteolytic enzymes and spans the region between the nuclear membrane inside and plasma membrane outside.
- *Neck:* Carries the centrosome that carries a proximally placed, functional centriole.[2]
- The midpiece contains mitochondrial sheath arranged in spiral fashion. The mitochondrial sheath is the source of energy [adenosine triphosphate (ATP)] for sperm motility.
- Tail consists of 11 microtubules, nine of which are arranged peripherally and remaining two are present in the center. Each microtubule is arranged as a pair of two units joined by dynein arms.

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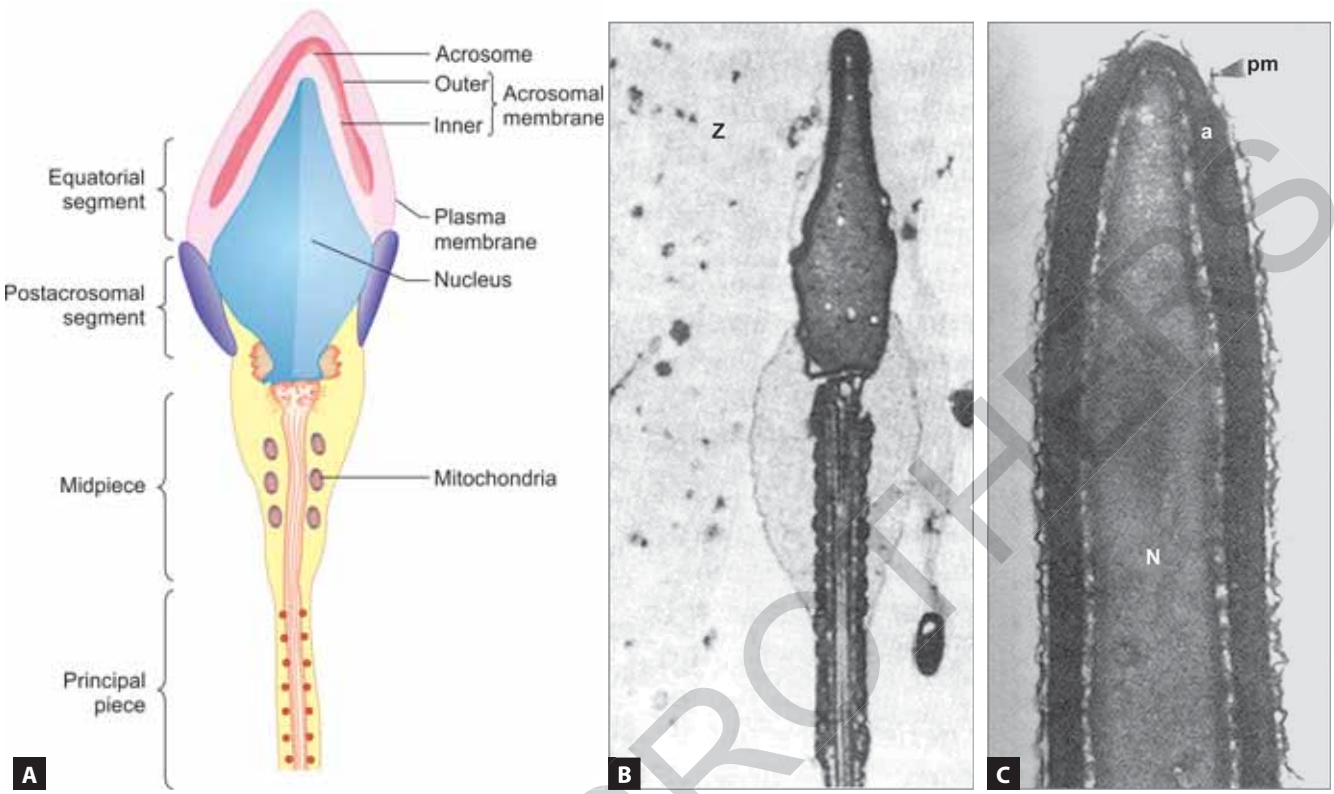

Figs. 1A to C: (A) Sperm ultrastructure; (B) Whole intact sperm bound by its plasma membrane to the surface of the zona 15,000×; (C) Sperm head showing surface membranes 70,000×.

- Sperm surface is covered by a carbohydrate coat, the glycocalyx, which plays a key role in regulating sperm function, including immunoprotection.[3]
- It consists of several membrane proteins such as SPAM—helps to bind to ZP and disperses the cumulus, fertilin—helps in fusion with oocyte, and IZUMO 1—establishes sperm–oocyte adhesion during fertilization.

STRUCTURE OF THE OOCYTE

- Between 100 and 200 µm in diameter, one of the largest cells in human body **(Fig. 2)**.
- It is surrounded by a gelatinous glycoprotein shell, the ZP, and several layers of follicular cells, the cumulus oophorus.
- It contains basic cellular organelles with cortical granules. Ribosomes are usually not seen.
- Nucleus is eccentric and called germinal vesicle (GV).
- MII spindle is located beneath the polar body I. It is anastral and arranged at right angles to surface.
- Zona pellucida consist of the following major functions:[4]

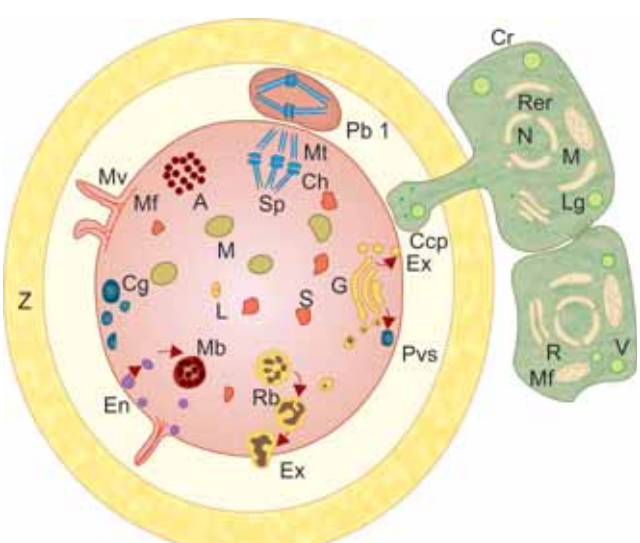

Fig. 2: Human oocyte fine structure. This illustration incorporates cellular organelles of immature and mature oocytes, as well as two follicle cells that play an important role in oocyte maturation.

- Species-specific sperm—oocyte binding
- Acrosome reaction

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- Prevents polyspermy
- Protects the embryo prior to implantation

- It is composed of various glycoproteins ZP1, ZP2, ZP3, and ZP4. Among these, the most important is ZP3. It is present in large quantities compared to others. Sperm binds via ZP3 and ZP4. ZP2 helps to prevent polyspermy.

MATURATION AND ACTIVATION OF SPERMATOZOA

Four stages have been described:

1. Storage in the epididymis—maturation
2. Ejaculation—activation of motility
3. Ascension through the female reproductive tract—capacitation
4. Near the oocyte—acrosome reaction

Storage in the Epididymis—Maturation

- Sperm maturation is a physiological process, by which sperm attains fertilizing capacity during their transit through epididymis.
- Histones are replaced by protamines. Acrosomal cap is formed from Golgi complex. The midpiece is seen distinctly from the stage of secondary spermatocytes and round spermatids. The sperm head becomes smaller and more compact.
- In order not to use their stored energy, the motility of spermatozoa is inhibited by an additional coating of a glycoprotein layer and other molecules. These motility inhibitors are then removed stepwise in the course of later activation steps.
- The structure of plasma membrane differs in mature and immature spermatozoa. During the process of maturation, sterols in the plasma membrane are removed and phospholipid content increases, which helps in increased progressive motility.
- Also excess cytoplasm is removed, seen as small vesicles in the neck region, which helps in assessing mature sperm.

Ejaculation—Activation of Motility

- Motile capabilities of the spermatozoa are abruptly activated after ejaculation. Mechanisms are as follows:
  - Mechanical stimulation during the ejaculation
  - Admixture of the glandular secretions
- Following intercourse, semen has a gel-like consistency. Liquefaction occurs due to prostatic enzymes within 20–30 minutes.
- The sperms move rapidly and reach the cervical mucus within 90 seconds of ejaculation.[5] Henceforth, only the active spermatozoa progress further in their path as they have to make their way through the pores, smaller than the sperm head size seen in the cervical mucus.
- β-defensin aids movement through cervical mucus and coats the spermatozoa.[6]
- Uterine contractions play their part and push the sperms upward. It takes 5 minutes for the sperm to reach the fallopian tube postinsemination.[7]

Ascension Through the Female Reproductive tract—Capacitation

- The sperm undergoes multiple physiological and biochemical changes while their passage through female reproductive tract, collectively called as Capacitation.
- Definition includes molecular changes in the sperm plasma membrane and in the components of signal transduction that enable the sperm to undergo the acrosome reaction, to acquire hyperactivation motility, exhibit chemotactic behavior, and finally the ability to fertilize an oocyte.[8]
- It takes 5–6 hours.
- Calcium ions play a major role in the process of capacitation by activating ATPase. This is followed by glycoprotein, glycolipid, and mannose receptor redistribution on the sperm surface. Changes in membrane cholesterol/phospholipid ratio further enhance calcium ion influx.
- Hyperactivated motility ensues. It involves increased side to side movement of the head, increased frequency, and wider displacement of the tail.
- Maturation mechanisms occur in small groups over a period of time because of unpredictability of the timing of ovulation.

Near the Oocyte—Acrosome Reaction

- Acrosome reaction is a crucial step in the gamete interaction.
- It is disruption and fusion of outer acrosomal membrane and plasma membrane **(Figs. 3A to D)**.
- These two membranes fuse intermittently appearing like vesicles (vesiculation) around the anterior two-thirds of the sperm head releasing enzymes (hyaluronidase and acrosin) for digesting a pathway for penetration through the cumulus and ZP.[9,10]

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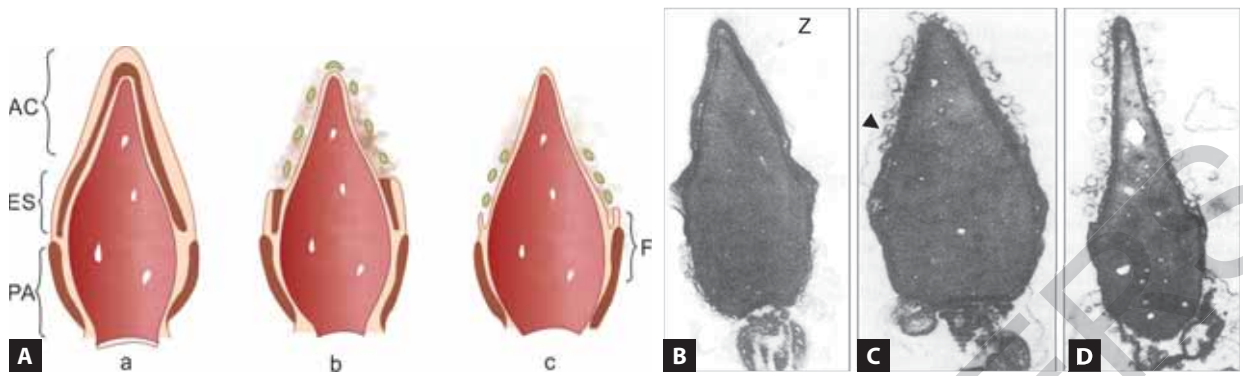

Figs. 3A to D: Sperm acrosome reaction. (A) Sperm acrosome reaction: two stages. Note vesiculation of surface membranes: fused plasma membrane and outer acrosome membranes. (a) Acrosome intact, (b) acrosome cap reacted, (c) acrosome reacted; (B) Acrosome intact sperm attached to zona (z) by its plasma membrane 30,600×; (C) Acrosome-reacting sperm (cap region) at the surface of the zona. Note connection between plasma membrane and outer acrosome, where the acrosome has still not reacted (arrowhead) 35,700×; (D) Acrosome-reacted sperm penetrating the zona. Vesiculation is complete and myriads of vesicles are still attached to the inner acrosome membrane 25,000×. (AC: acrosomal cap; ES: equatorial segment; PA: post acrosomal region)

- Calcium influx occurs causing changes in the pH. This is followed by the release of acrosomal contents and exposure of zona-binding receptors.
- Progesterone evokes critical responses in spermatozoa leading to acrosome reaction.[11]
- Acrosomal contents include hyaluronidase, neuraminidase-like factor, cumulus-dispersing enzyme, and acrosin. A prerequisite for the success of the acrosome reaction is the previous binding of the spermatozoon to the ZP. The same reaction can be induced in vitro by human follicular fluid.
- Capacitation and the acrosome reaction last for about 2 hours, and sperm traverses the zona over another hour.

Oocyte Maturation

Oocyte maturation is a complex process that includes both nuclear and cytoplasmic maturation.

Nuclear maturation: The oocyte resumes meiosis and the nuclear maturation mainly involves chromosome segregation and is evident by the extrusion of the first polar body.

Cytoplasmic maturation includes the following:

- *Organelle redistribution:* Endoplasmic reticulum and cortical granules are redistributed to increased concentrations near the cortex. They are required for calcium release and cortical reaction, respectively. Lipid droplets, which are source of energy, accumulate around the spindle. Mitochondria that were predominantly seen in the cortex become dispersed in the cytoplasm.
- *Cytoskeleton changes:* The microfilaments scattered in the cytoplasm in GV stage migrate toward the cortex.
- Protein synthesis also occurs as a part of cytoplasmic maturation.

Sperm–oocyte Fusion: Fertilization

- Spermatozoa enter perivitelline space at an angle. Inner acrosomal membrane (IAM) remains intact when the sperm reaches the perivitelline space. Oocyte is sphere shaped while sperm head flat shaped **(Fig. 4)**.
- First site of contact is equatorial region, i.e., distal portion of acrosome **(Figs. 5A and B)**.[12]
- Whole of sperm plasma membrane posterior to acrosome is internalized into the oolemma in a zipper-like fashion and integrated into zygote membrane to form a mosaic membrane.
- All structural and biochemical changes invoked in oocytes by the fertilizing spermatozoa are collectively called *oocyte activation*.
- The earliest visible indications of oocyte activation are cortical granule extrusion (CGE).
- Transient block to other sperm is due to depolarization of the membrane, and permanent block is due to cortical reaction. Cortical reaction involves protein cross-linking resulting in inaccessibility and inactivation of ligands for sperm receptors.
- Activation of metaphase II is indicated by the emergence of pronuclei in the oocyte along with extrusion of second polar body.

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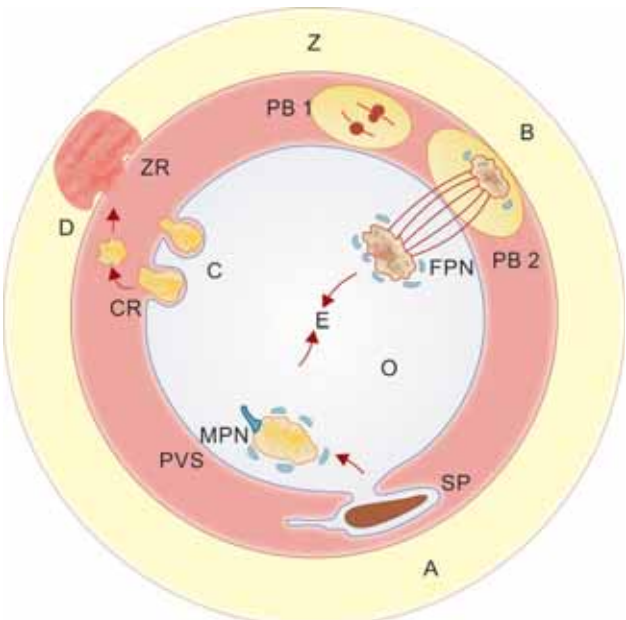


Fig. 4: Major events at fertilization. (A) The sperm fuses with the oocyte at the midsegment, followed by phagocytosis and formation of male pronucleus (MPN). (B) Completion of second meiotic maturation (telophase II). The second polar body (PB2) is released and the female pronucleus (FPN) is developing. PB1, first polar body. (C) Cortical reaction (CR): exocytosis of cortical granules. (D) Zona reaction (ZR): dispersed contents of cortical granules interacting with the zone (Z). (E) Association of MPN and FPN occurs eventually (arrows). (PVS: perivitelline space)

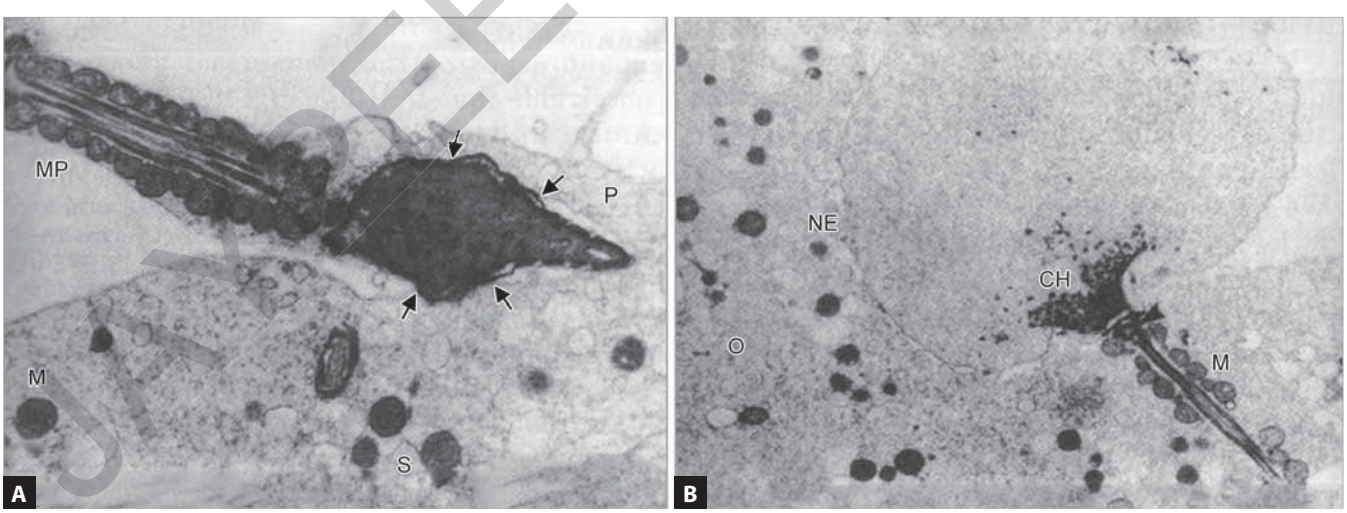
Nature of Activating Stimulus

It is unclear how exactly the spermatozoa bring about oocyte activation, and three theories have been proposed **(Figs. 6A and B)**:

- *The fusion theory:* It is believed that the sperm head contains certain elements that bring about calcium release upon fusion with oocyte.
- *The receptor theory:* This theory proposes that the oocyte harbors receptors that cause signal transduction that further causes influx of calcium.
- *The "calcium bomb" theory:*[13] The source of calcium could be the sperm stores or channels in the sperm that facilitate sperm entry postfertilization. It is believed to be triggered by sperm specific phospholipase C zeta (PLCζ) and mediated by IP3 and DAG receptor system.

Formation of Pronuclei

- The second polar body is extruded after oocyte activation.
- Sperm head swells progressively due to chromatin decondensation. The IAM is intermittently discarded and new nuclear envelope is organized by intercalation of flattened element of egg smooth endoplasmic reticulum to accommodate the expanding male pronucleus.



Figs. 5A and B: Sperm–egg fusion and incorporation. (A) Fusion of the oocyte and sperm membranes: The midsegment of the acrosome-reacted sperm has fused with the oolemma (between arrows). The egg has extended phagocytic process (P) that engulfs the head of the sperm. Mitochondira (M), midpiece (MP), and smooth (S) endoplasmic reticulum 30,600×; (B) Normal sperm incorporation into the ooplasm (O): The chromatin has decondensed and the sperm head has expanded to form an MPN. Note centriole (arrow) in the neck region. Chromatin (CH), mitochondira (M), nuclear envelope (NE) 13,200×.

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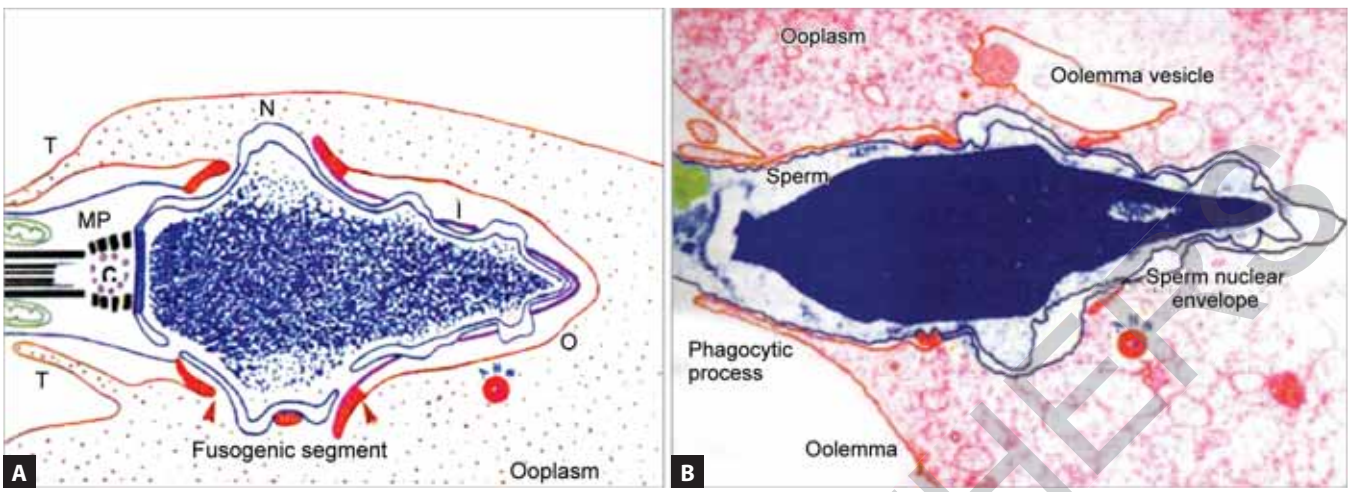

Figs. 6A and B: Sperm incorporation soon after fusion (diagram and TEM). This sperm (incorporated 3 hours postinsemination) shows how a pathway opens for molecular interactions between sperm and ooplasm via the fusogenic domain. The sperm factor that activates the egg could originate from the fusogenic, midsegment of the sperm head where sperm–egg membrane fusion occurred (receptor or cytosolic mediated) or the perinuclear theca between the IAM and nuclear envelope (cytosolic mediated). (C: centriole; I: inner acrosome membrane; MP: midpiece; O: ooplasm; T: phagocytic process of egg)

- Simultaneously FPN forms from maternal chromatin decondensation.
- DNA duplication occurs following chromatin decondensation, and it takes roughly 12–18 hours.
- Meanwhile, the two pronuclei also get closer to each other with the help of microtubules. Paternal centrosome is the site of origin of microtubules, it lies beside the forming paternal pronucleus. The microtubular proteins themselves arise from the cytoplasm of the oocyte.

Zygote Formation

- Now merging of pronuclei happens. Dissolution of nuclear membrane occurs. Chromosomes of both align themselves on the spindle apparatus at the equator.
- The zygote, with new genome, is formed when the maternal and paternal chromosomes are aligned together on a common spindle apparatus **(Fig. 7)**.
- Mitotic spindle is formed about 22 hours postfertilization.
- Approximately 3 hours postinsemination, meiosis is completed. First cell division plane is determined by the centriole of sperm.[14] Gamma tubulin of the oocytes helps to activate sperm centriole to form aster, while α-tubulin aids to assemble aster and form first mitotic spindle.



Fig. 7: The fertilized oocyte with zygote formation.

Impact of Intracytoplasmic Sperm Injection on Fertilization

- In ICSI, entire spermatozoa + a small amount extracellular medium are deposited in an oocyte, which otherwise does not happen in natural conception.
- Following ICSI, the time taken for various critical steps is as follows:
  - Beginning of sperm nucleus decondensation—30 minutes

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  - Oocyte activation (cortical granule exocytosis)—60 and 90 minutes
  - Both pronuclei seen distinctly—about 4–6 hours
- Pronuclear formation time does not significantly differ between ejaculated and testicular spermatozoa.[15] However, in ICSI, nuclear decondensation may be slower due to the presence of acrosomal materials. But the male pronuclear development is not hindered.
- In comparison to other species, such as hamsters and guinea pigs, human spermatozoa do not possess huge acrosomes or plasma membranes with increased stability. This could be a reason why ICSI in humans is so successful. Also oocyte tolerance to lytic acrosomal enzymes could be an additional factor.

Ultrastructural details of sperm and oocyte morphology and their contributions to fertilization and embryogenesis have been made possible by the use of electron microscopy, transition electron microscopy (TEM), and freeze fracture models of study.

Key Points and Conclusion

- The sperm is a highly complex specialized cell designed to survive a long and perilous journey through the female reproductive tract.
- The oocyte—the female gamete, plays a crucial role in fertilization and determining the embryo competence.
- The spermatozoa undergoes maturation, capacitation and acrosome reaction to finally achieve the ability to fertilize an oocyte.
- The oocyte also undergoes a complex process of nuclear and cytoplasmic maturation.
- Oocyte activation is triggered by sperm-specific phospholipase C zeta by releasing calcium in specific patterns within the oocyte.
- Fertilization is the process of recreation of an entire being from the fusion of a single sperm and oocyte.

PROBABLE QUESTIONS

1. Describe the process of fertilization.
2. Write in detail about sperm and oocyte maturation.
3. Describe the morphology of mature oocyte and sperm.
4. What is oocyte activation?

REFERENCES

1. Hertwig O. Beitrage zur Kenntniss der Bildung, Befruchtung und Teihlung des thierischen Eies. Morphol Jahrb. 1876;1:347-434.
2. Sathanathan AH. Visual Atlas of Human Sperm Structure and Function for Assisted Reproductive Technology. Singapore: National University; 1996. p. 279.
3. Mortimer D. The functional anatomy of the human spermatozoon: relating ultrastructure and function. Mol Hum Reprod. 2018;24(12):567-92.
4. Gupta SK, Bansal P, Ganguly A, Bhandari B, Chakrabarti K. Human zona pellucida glycoproteins: functional relevance during fertilization. J Reprod Immunol. 2009;83(1-2):50-5.
5. Sobrero AJ, MacLeod J. The immediate postcoital test. Fertil Steril. 1962;13:184.
6. Tollner TL, Yudin AL, Treece CA, Overstreet JW, Cherr GN. Macaque sperm coating protein DEFB126 facilitates sperm penetration of cervical mucus. Hum Reprod. 2008;23:2523.
7. Suarez SS, Pacey AA. Sperm transport in the female reproductive tract. Hum Reprod Update. 2006;12(1):23-37.
8. Ickowicz D, Finkelstein M, Breitbart H. Mechanism of sperm capacitation and the acrosome reaction: role of protein kinases. Asian J Androl. 2012;14(6):816-21.
9. Sathanathan AH, Ng S-C, Edirisinghe R, Wong PC. Human sperm egg interaction in vitro. Gamete Res. 1986b;15:317-26.
10. Chen C, Sathananthan H. Sperm oocyte membrane fusion I the human during monospermic fertilization. Gamete Res. 1986;15:177-86.
11. Brucker C, Lipford GB. The human sperm acrosome reaction: physiology and regulatory mechanisms. An update. Hum Reprod Update. 1995;1(1):51-62.
12. Sathananthan H, Ng S-C, Bongso A, Trouson A, Ratnam S. Visual atlas of early human development for assisted reproductive technology. National University of Singapore. 1993. p. 209.
13. Gearon CM, Taylor AS, Forman RG. Fertilization and early embryology: factors affecting activation and fertilization of human oocytes following intracytoplasmic injection. Hum Reprod. 1995;10(4):896-902.
14. Sathananthan AH, Ratnam SS, Ng SC, Tarin JJ, Gianaroli L, Trounson A. The sperm centriole: its inheritance, replication and perpetuation in early human embryos. Hum Reprod. 1996;11:345-56.
15. Nagy ZP, Janssenswillen C, Janssens R, De Vos A, Staessen C, Van de Velde H, et al. Timing of oocyte activation, pronucleus formation and cleavage in humans after intracytoplasmic sperm injection (ICSI) with testicular spermatozoa and after ICSI or in-vitro fertilization on sibling oocytes with ejaculated spermatozoa. Hum Reprod. 1998;13(6):1606-12.

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Kamini A Rao DGO DORCP DCh FRCOG (UK) MCh(UK) FICOG PGDMLE (Law) FNAMS DSc is the Chief Mentor at Milann Fertility and Birthing Center and Recipient of the Padma Shri has a distinguished clinical and research career in reproductive medicine.

She has served as a Member of the Task Force on Health and Family Welfare, Government of Karnataka, a Member of the Central Supervisory Board, Government of India (GOI) for implementation of the Prenatal Diagnostic Techniques (PNDT) Act, a Member of the Technical Advisory Committee of the National Abortion Assessment Project, and as Member of the Technical Advisory Committee for setting National Guidelines for "Accreditation, Supervision, and Regulation of ART Clinics in India". As a part of Corporate Social Responsibility her Center has been organizing a large number of health camps regularly for screening for Infertility and Gynecological problems as well as health awareness programs for the common public.

An academically oriented person, she has authored and published over 40 medical books and is an acclaimed educationist. She has been a recipient of the Karnataka State Rajyotsava Award for invaluable service in the field of medicine in 1997 and the Outstanding Woman Obstetrician and Gynecologist, award by the World Obs/Gyne body the International Federation of Gynecology and Obstetrics (FIGO) in Rome in 2012. She received the Life-time Achievement Award for dedicated service, contribution, and achievement in the field of Obstetrics and Gynecology from the Bangalore Society of Obstetrics and Gynaecology (2012) and from the Karnataka State Obstetric and Gynaecological Association (2013). She is committed passionately to bringing research into clinical medicine and to promoting the value of evidence-based medicine. She has received an Honorary Doctorate for Doctor of Science (DSc) at the 54th Annual Convocation of Bangalore University. Kamini A Rao has been awarded the "Distinguished NBE Teacher Award" by the Association of National Board of Accredited Institutions. She was also awarded the Life-time Achievement Award from ISAR (2018), and the Life-time Achievement Award by FOGSI (2019). She was awarded with Life-time Achievement Award (2022) for outstanding contribution to embryology by the Manipal Association of Clinical Embryologists (MACE).

Being an entrepreneur at heart, retirement was not in Dr Kamini A Rao's blood. At a time when most people would have hung up their boots, Dr Kamini Rao decided to step into the field of online education. She is the Founder and Chairperson of Medline Academics, which is an e-learning platform to scale Super Specialty medical education globally and capitalize on the Ed-Tech wave. She has initiated the Kamini Kares Foundation, an organization that focuses on working towards improving, enhancing, and enlightening the lives of the girl children and women in our country. At her center, she has treated over 10,000 patients free of cost at Milann.



Vyshnavi A Rao MBBS MS (Obs & Gyne) FRM is a Senior Consultant Reproductive Medicine practicing at Milann Fertility and Birthing Center, Bengaluru with over 12 years of rich experience in infertility management. She is currently the Joint Secretary of Karnataka Chapter of Indian Fertility Society. She has been the Co-editor of Kamini Rao's Textbook of Obstetric Emergencies and Principles and Practice of Assisted Reproductive Technology (3rd edition), 2019 and 2023 respectively. She is the Co-editor of International Journal of Infertility and Fetal Medicine. (IJIFM). She has received the Nav Shakti Awards in 2018 given by Yog Federation of India, Southeastern Council, Government of India. She is also Recipient of prestigious Vaidya Ratna Young Achiever Award (2019) given by Akhila Karnataka Vipra Vanita Seva Pratisthana. She was also conferred with IFS Achiever's award from Indian Fertility Society (2022). She has been awarded ISAR Meyer Youth Icon Award, ISAR 2023, and also the ET Budding IVF Specialist of India in Mumbai (2023).

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