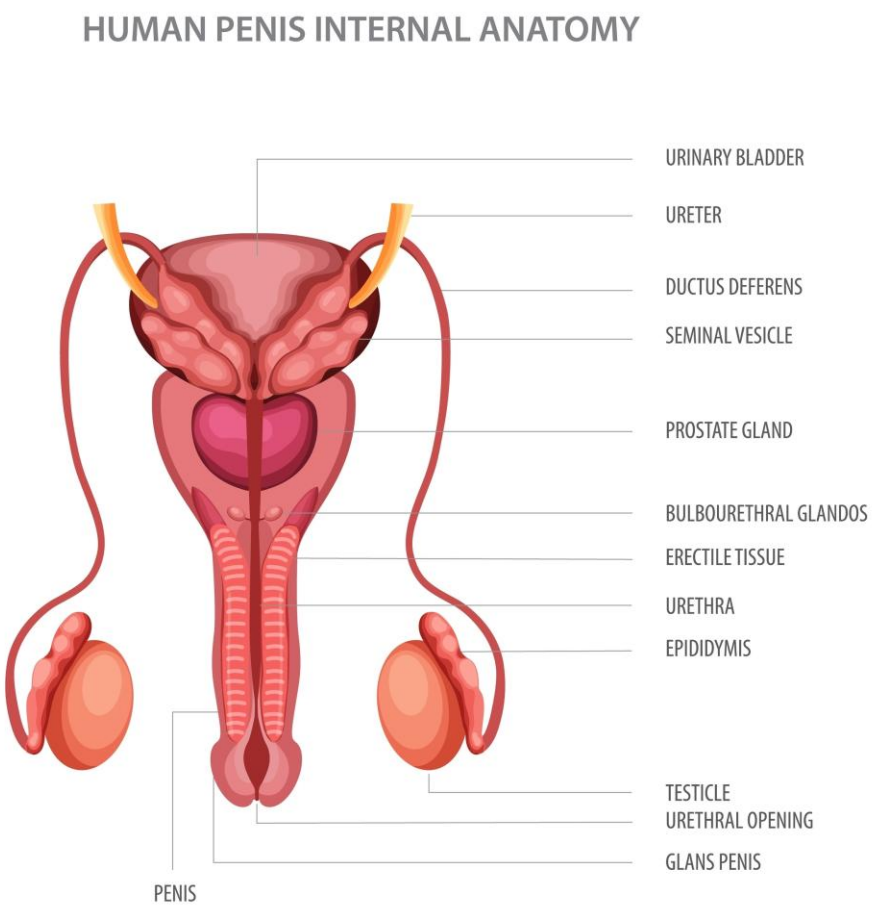
Topic 6: Human Reproduction

1. Male Reproductive System

- **Location and Organs:** Located in the pelvis region. It includes a pair of testes, accessory ducts, glands, and the external genitalia.
- **Testes:** Situated outside the abdominal cavity within a pouch called the scrotum. The scrotum helps in maintaining the low temperature of the testes (2-2.5 degrees Celsius lower than normal internal body temperature) necessary for spermatogenesis.
- **Internal Structure:** Each testis contains about 250 compartments called testicular lobules. Each lobule contains 1 to 3 highly coiled seminiferous tubules where sperms are produced.
- **Accessory Ducts:** Include rete testis, vasa efferentia, epididymis, and vas deferens. These ducts store and transport sperms from the testis to the outside through the urethra.
- **Accessory Glands:** Comprise paired seminal vesicles, a prostate gland, and paired bulbourethral glands. Their secretions make up the seminal plasma, which is rich in fructose, calcium, and certain enzymes.



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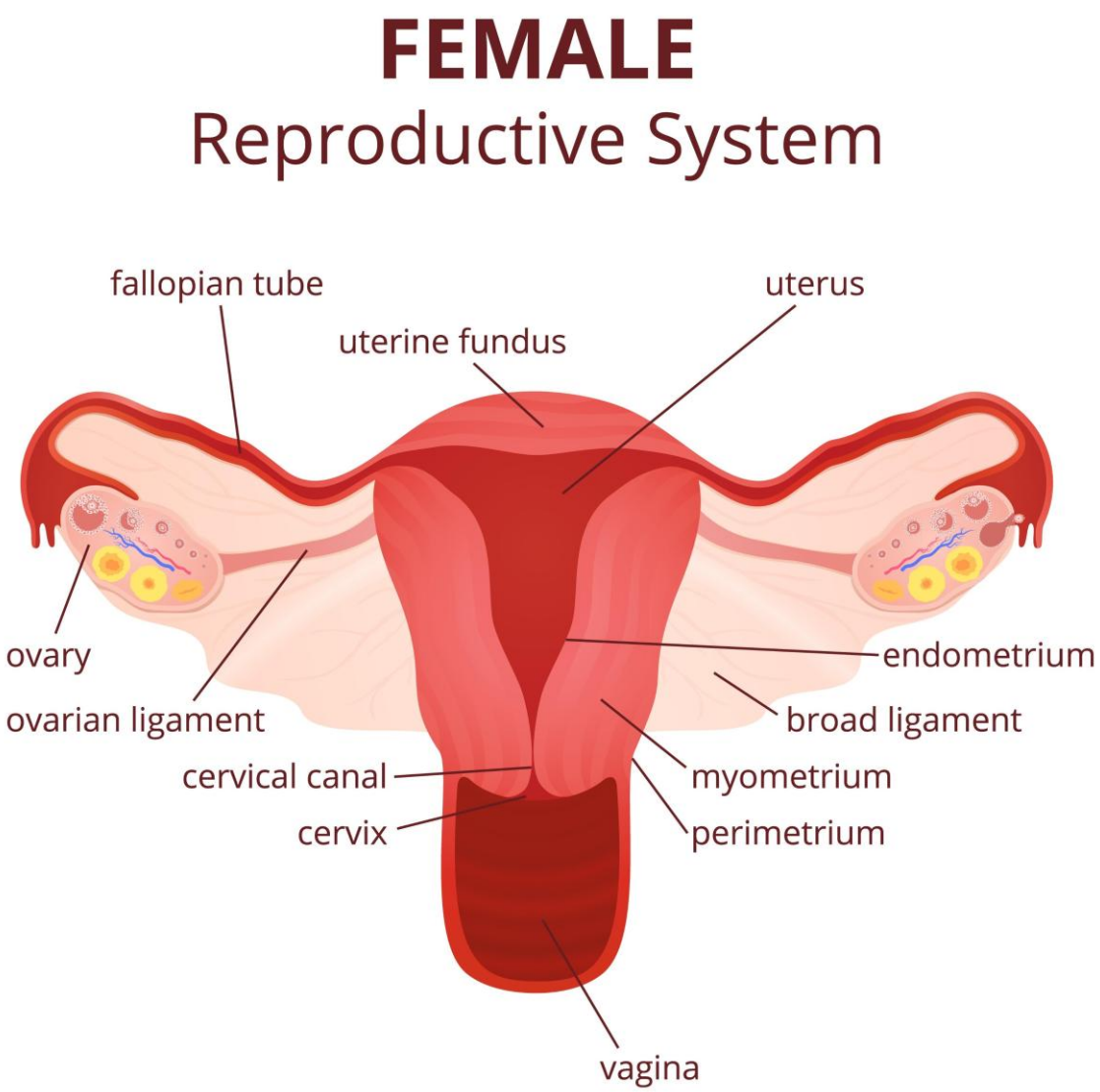
2. Female Reproductive System

- **Location and Organs:** Consists of a pair of ovaries, a pair of oviducts (fallopian tubes), a uterus, a cervix, a vagina, and the external genitalia located in the pelvic region.
- **Ovaries:** The primary female sex organs that produce the female gamete (ovum) and several steroid hormones (ovarian hormones). Each ovary is covered by a thin epithelium enclosing the ovarian stroma.
- **Oviducts (Fallopian Tubes):** About 10-12 cm long. The part closer to the ovary is the funnel-shaped infundibulum with finger-like projections called fimbriae (which help collect the ovum after ovulation). The infundibulum leads to a wider part called the ampulla, and finally the isthmus which joins the uterus.
- **Uterus:** Also called the womb. The wall has three layers: perimetrium (external thin layer), myometrium (middle thick layer of smooth muscle), and endometrium (inner glandular layer that lines the uterine cavity).



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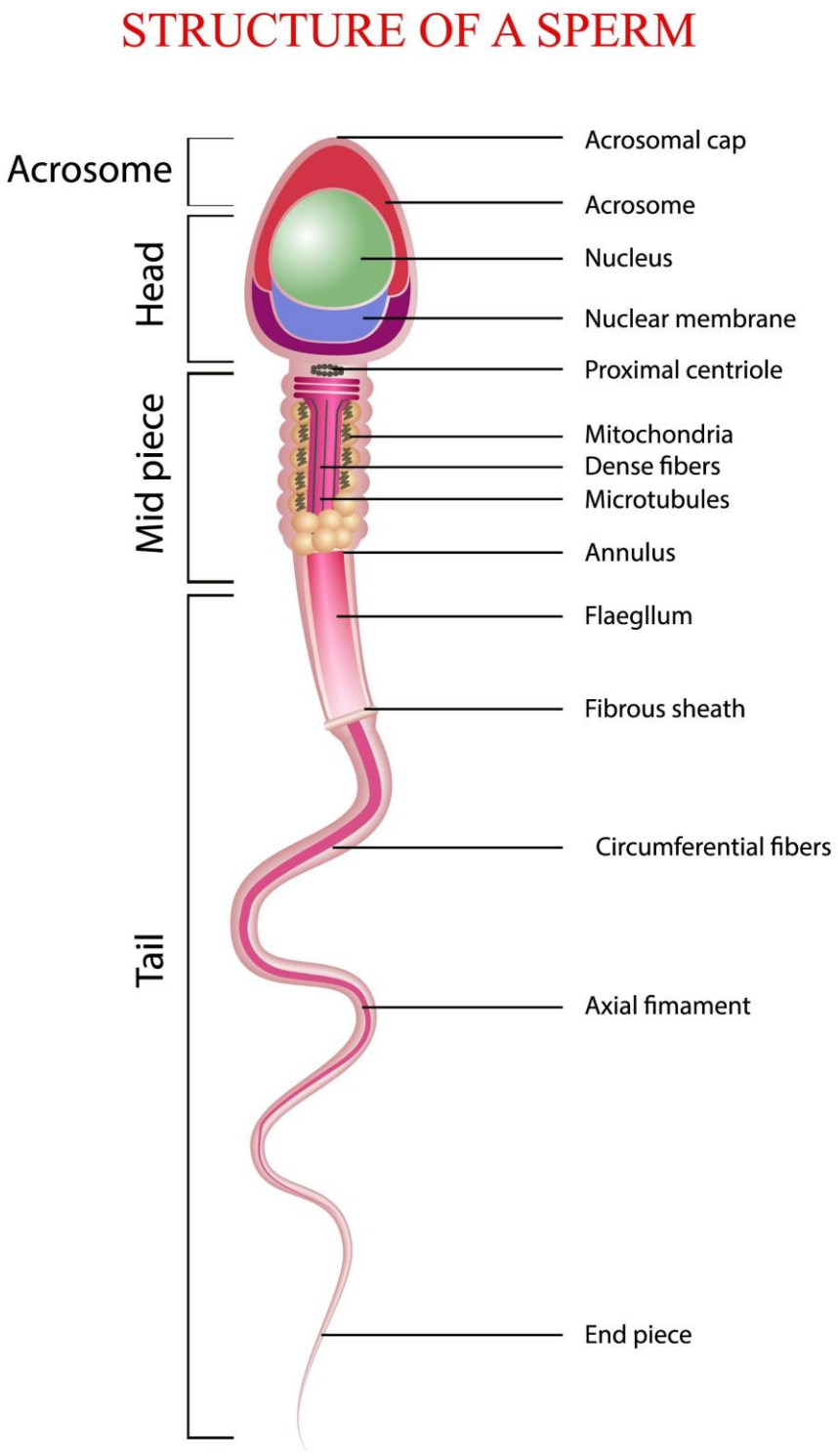
3. Gametogenesis The primary sex organs produce gametes (sperms in males, ovum in females) via gametogenesis.

- **Spermatogenesis:** Occurs in males starting at puberty. Spermatogonia (diploid) on the inner wall of seminiferous tubules multiply by mitotic division. Primary spermatocytes undergo meiosis to form secondary spermatocytes, then spermatids. Spermatids transform into spermatozoa (sperms) through a process called spermiogenesis.
- **Sperm Structure:** A microscopic structure composed of a head, neck, a middle piece, and a tail. The sperm head contains an elongated haploid nucleus and an anterior cap-like structure called the acrosome (filled with enzymes to help

fertilization). The middle piece possesses numerous mitochondria to provide energy for tail movement.



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- **Oogenesis:** The formation of a mature female gamete, initiated during the embryonic development stage. Primary oocytes arrest in prophase-I of meiosis.

At puberty, a primary follicle matures into a Graafian follicle. The primary oocyte completes its first meiotic division forming a large secondary oocyte and a tiny polar body.

4. Menstrual Cycle The reproductive cycle in female primates (including human beings).

- **Menstrual Phase:** Days 1-5. The endometrial lining of the uterus and its blood vessels break down, resulting in menstruation.
- **Follicular (Proliferative) Phase:** Days 6-13. Primary follicles in the ovary grow to become a fully mature Graafian follicle. The endometrium regenerates. This is driven by an increase in gonadotropins (LH and FSH) and estrogens.
- **Ovulatory Phase:** Day 14. Rapid secretion of LH induces the rupturing of the Graafian follicle and the release of the ovum (ovulation).
- **Luteal (Secretory) Phase:** Days 15-28. The remaining parts of the ruptured follicle transform into the corpus luteum, which secretes large amounts of progesterone, essential for maintaining the endometrium for potential pregnancy.

5. Fertilization and Implantation

- **Fertilization:** The process of fusion of a sperm with an ovum. It occurs in the ampullary region of the fallopian tube. The sperm induces changes in the zona pellucida layer of the ovum that block the entry of additional sperms, ensuring only one sperm fertilizes the ovum.
- **Cleavage:** The haploid nucleus of the sperm and ovum fuse to form a diploid zygote. The zygote undergoes rapid mitotic divisions (cleavage) as it moves down the isthmus toward the uterus, forming 2, 4, 8, 16 daughter cells called blastomeres.
- **Implantation:** The embryo with 8 to 16 blastomeres is called a morula, which continues to divide and transforms into a blastocyst. The blastocyst embeds itself in the endometrium of the uterus, establishing pregnancy.

6. Pregnancy and Embryonic Development

- After implantation, finger-like projections appear on the trophoblast called chorionic villi, which become interdigitated with uterine tissue to form the placenta.
- **Placenta:** Facilitates the supply of oxygen and nutrients to the embryo and removes carbon dioxide and excretory waste materials. It also acts as an

endocrine tissue, producing hormones like hCG, hPL, estrogens, and progestogens.

- **Development:** The inner cell mass differentiates into three germ layers (outer ectoderm, middle mesoderm, inner endoderm) which give rise to all tissues and organs in adults. The human gestation period is approximately 9 months.

7. Parturition and Lactation

- **Parturition:** The process of giving birth to the baby. It is induced by a complex neuroendocrine mechanism. Signals from the fully developed fetus and placenta induce mild uterine contractions (fetal ejection reflex), triggering the release of oxytocin from the maternal pituitary, causing stronger uterine contractions.
- **Lactation:** The mammary glands of the female undergo differentiation during pregnancy and begin producing milk towards the end of pregnancy. The milk produced during the initial few days is called colostrum, which contains several crucial antibodies (IgA) to provide passive immunity to the newborn.

Summary

- The male reproductive system centers around the testes (producing sperms and androgens), accessory ducts, and glands that form seminal plasma.
- The female reproductive system features the ovaries (producing ova and hormones), fallopian tubes (site of fertilization), and the uterus (site of fetal development).
- Gametogenesis involves meiosis to produce haploid sperms in males (spermatogenesis) and a haploid ovum in females (oogenesis).
- The female menstrual cycle is regulated by pituitary and ovarian hormones, characterized by follicular growth, ovulation (around day 14), and endometrial preparation for a fertilized egg.
- Fertilization occurs in the fallopian tube, leading to zygote formation, cleavage, and subsequent implantation of the blastocyst into the uterine wall.
- The placenta acts as a vital bridge for nourishment, respiration, and hormone production between the mother and the developing embryo.
- Gestation lasts roughly 9 months, concluding with parturition (childbirth) triggered by oxytocin, followed by lactation to nourish the newborn with antibody-rich colostrum.