

Class 12th BIOLOGY

UNIT- VI

CHAPTER- 3

HUMAN REPRODUCTION

PRIMARY SEX ORGAN- THESE ORGAN ARE INVOLVED IN FORMATION OF GAMETES AND IN RELEASE OF SEX HORMONES.

EX- Testes in human male, Ovaries in female

SECONDARY SEX ORGAN- THESE ORGANS ARE NOT INVOLVED IN FORMATION OF GAMETES AND IN RELEASE OF SEX HORMONES, BUT THEY ASSIST IN THE PROCESS OF REPRODUCTION.

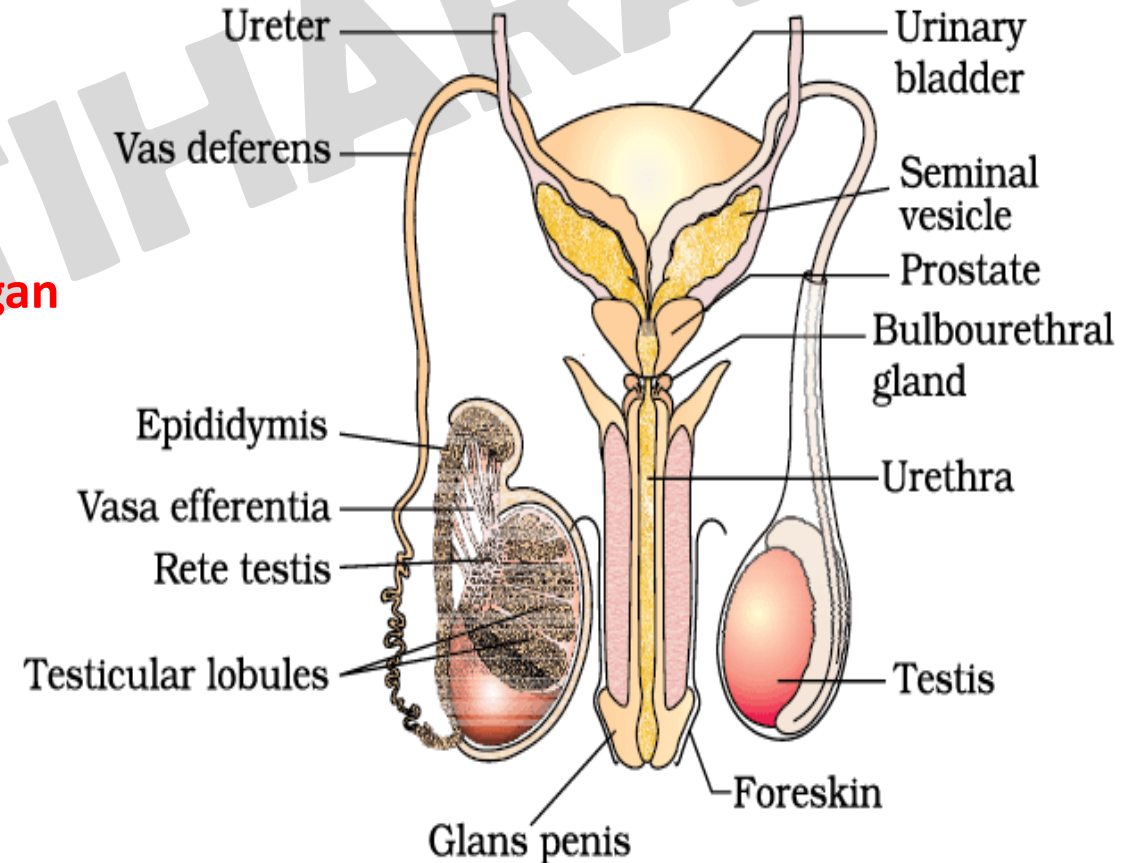
EX- Duct system and glands.

THE MALE REPRODUCTIVE SYSTEM

- Located In the pelvis region.
- Male reproductive system includes -:
 - A pair of testes - **primary sex organ**
 - Accessory ducts.
 - Accessory glands.
 - External genitalia.

Penis

Secondary sex organ



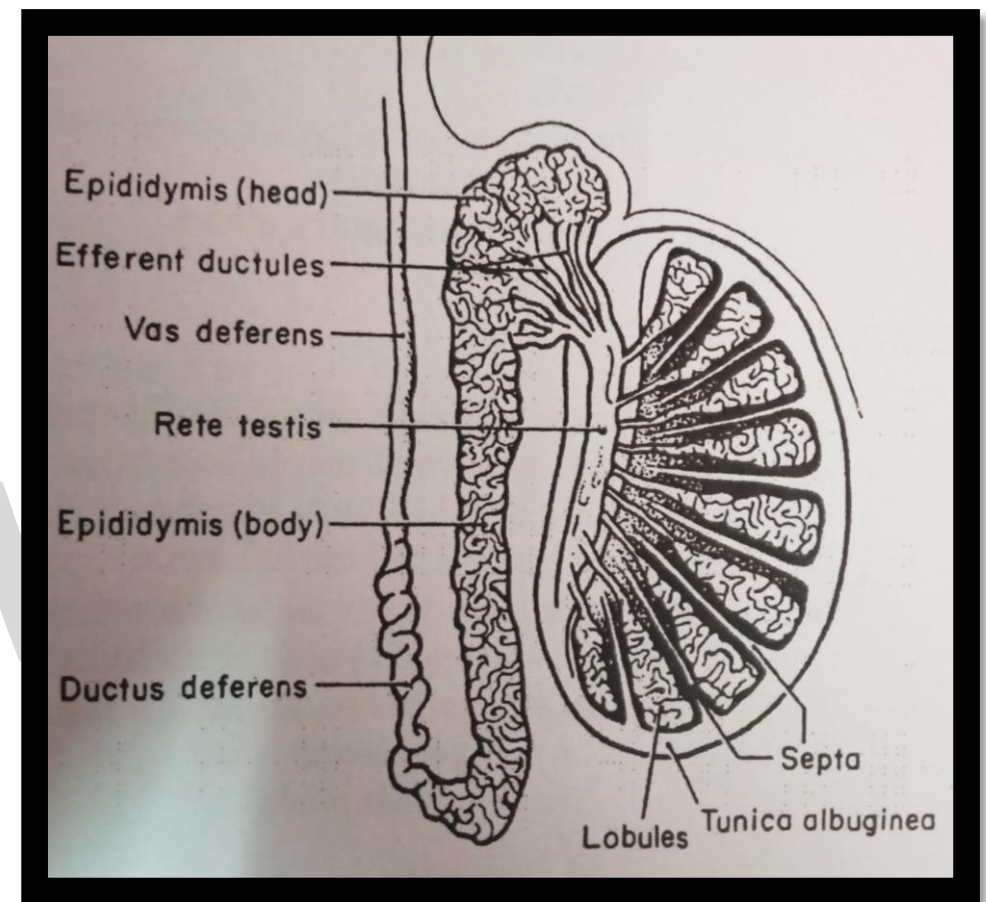
TESTES

- ❑ Located outside the abdominal cavity within a pouch called SCROTUM.
- ❑ Scrotum provides LOW TEMPERATURE (2-2.5 degree lower than the normal internal body temp.) required for spermatogenesis.
- ❑ Oval in shaped length 4-5cm width 2-3cm.
- ❑ Each testis has about 250 compartments called TESTICULAR LOBULES.
- ❑ Each lobules contain one to three highly coiled SEMINIFEROUS TUBULES IN WHICH SPERMS ARE PRODUCED.
- ❑ Each seminiferous tubules lined on its inside by two types cell called MALE GERM CELLS (spermatogonia) and SERTOLI CELLS

Provides nutrition to germ cells.

Undergoes meiosis and produce sperm

- ❑ In between seminiferous tubules there is interstitial cell or LEYDIG CELL. (Fig 3.2 page no 44 in NCERT)
- ❑ Leydig cells synthesize and secrete testicular hormones called ANDROGEN.
- ❑ TUNICA ALBUGENIA is dense covering over testis.



ACCESSORY DUCTS

- Include **RETE TESTIS, VASA EFFERENTIA, EPIDIDYMIS AND VAS DEFERENS**. (SEE ON SLIDE NO 3)
- Seminiferous tubules open in vasa efferentia through rete testis.
- Vasa efferentia leaves the testis and opens into epididymis. The epididymis leads to vas deferens that ascends to abdomen through inguinal canal and loops over urinary bladder.
- Vas deferens receives a duct from seminal vesicle and opens into urethra as the **EJACULATORY DUCT** (these ducts stores and transport the sperm from testis to the outside through urethra)
- Urethra originates from urinary bladder and extends through the penis to its external opening called **urethral meatus**.

Accessory glands

1. PAIRED SEMINAL VESICLES
2. A PROSTATE GLAND
3. PAIRED BULBOURETHRAL GLANDS – Lubrication of penis.

Secretion of these glands constitutes the SEMINAL PLASMA.

Seminal plasma is rich in fructose, calcium and certain enzymes.

Provide medium and nourishment to spermatozoa.

Spermatozoa + seminal plasma =

SEMEN



INSEMINATION- deposition
of semen into female
reproductive system

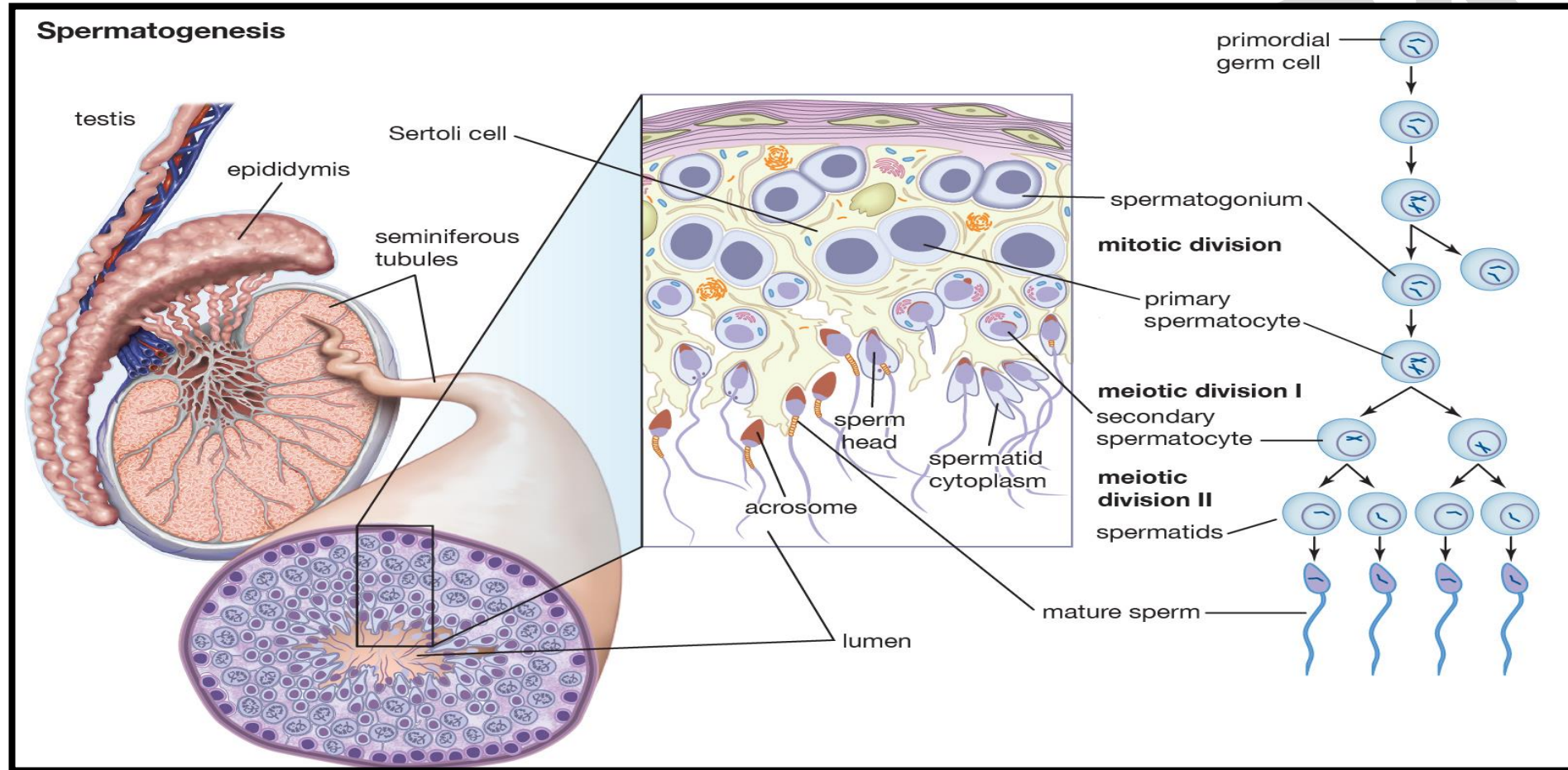
EXTERNAL GENITALIA.

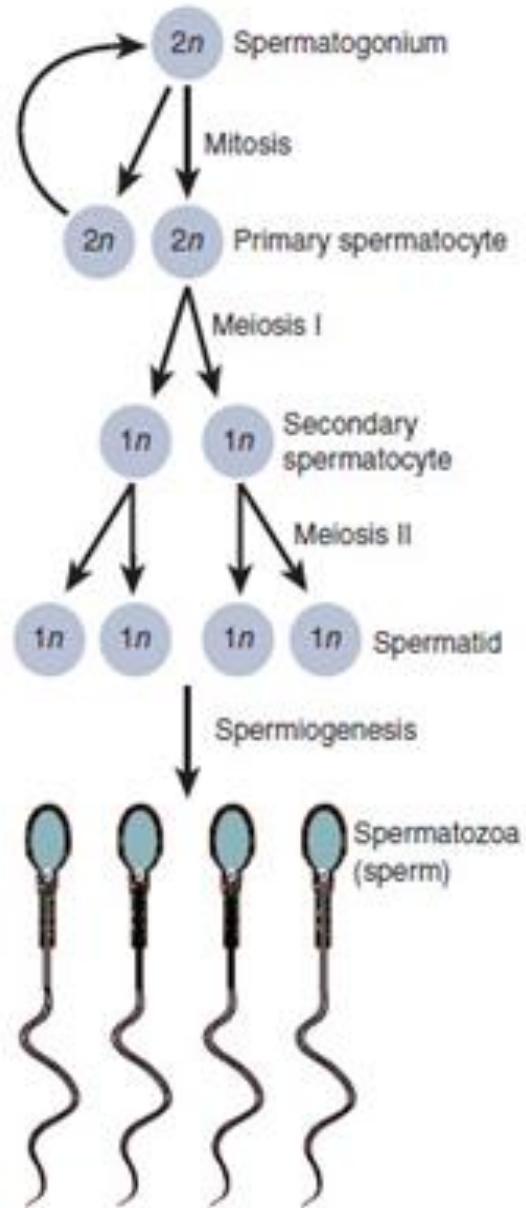
- **PENIS** is external genitalia.
- It is made of special tissue that helps in erection of penis to facilitate **insemination**.
- The enlarged end of penis is called **glans penis**.
- Glans penis is covered by a loose fold of skin called **FORESKIN**.

QUES. Failure of testes to descend in scrotum leads to sterility. Why?

SPERMATOGENESIS-

PROCESS OF DEVELOPMENT OF SPERMATOZOA FROM SPERMATOGONIAL CELLS





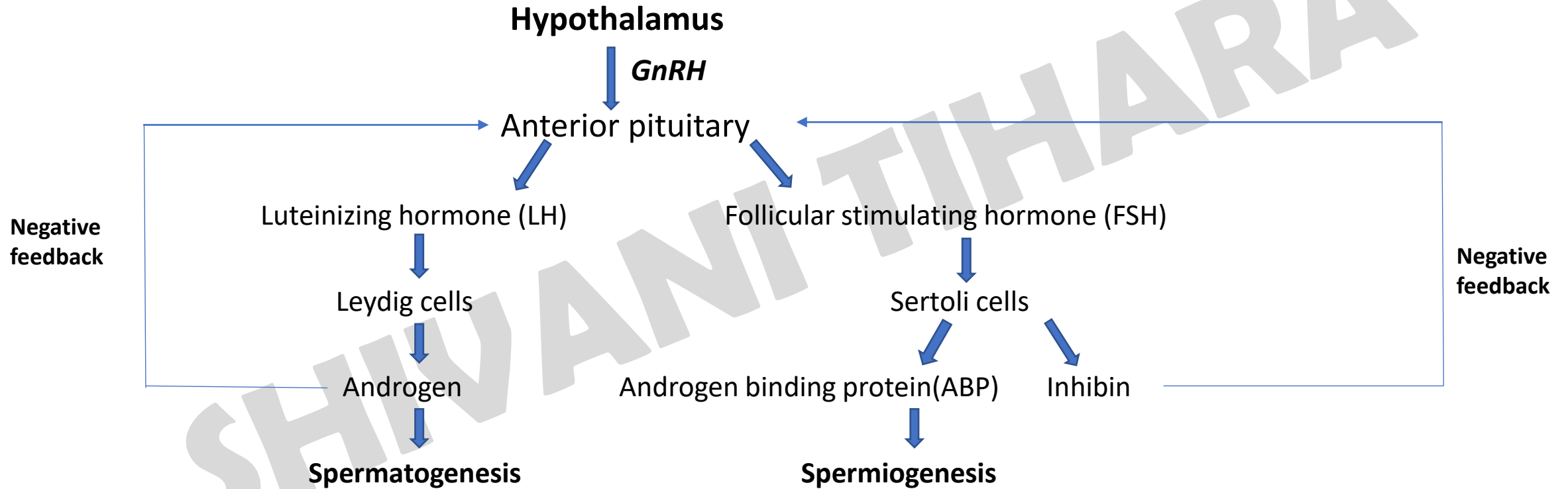
2n = 46 chromosomes

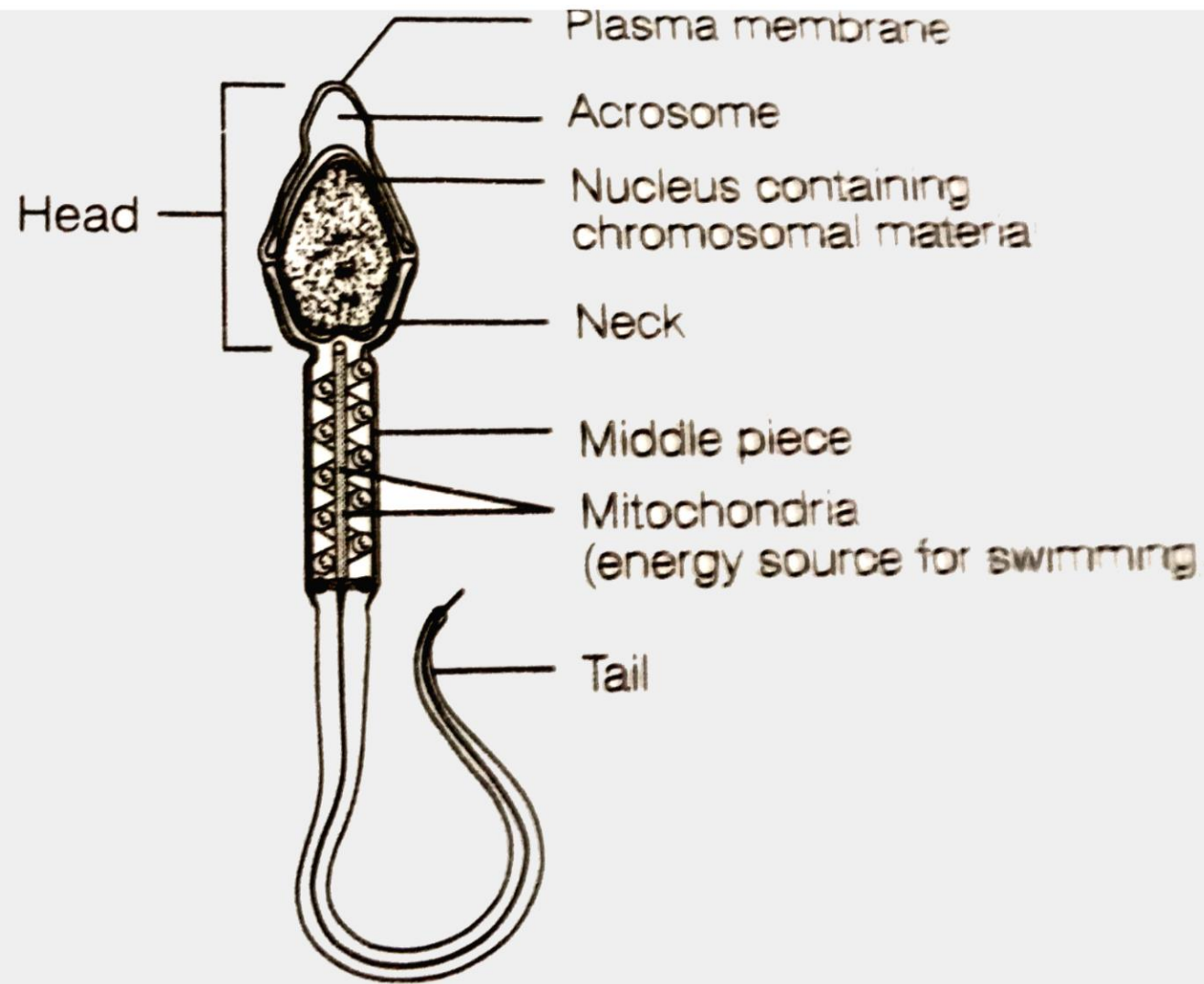
n = 23 chromosomes

SPERMIOGENESIS- Metamorphosis (differentiation) of spermatids into spermatozoa.

SPERMIACTION- Release of spermatozoa after withdrawing their head from Sertoli cell.

HORMONAL CONTROL OF SPERMATOGENESIS



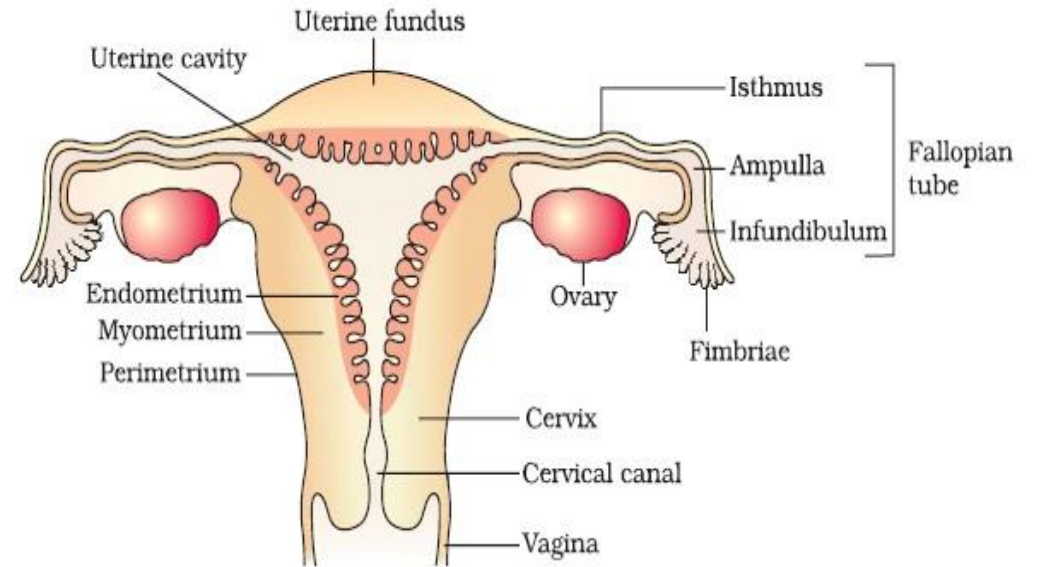


Structure of a sperm

THE FEMALE REPRODUCTIVE **SYSTEM**

- Located in pelvic region of the female
- The female reproductive system includes:

1. A pair of ovaries – **primary sex organ**
2. A pair of oviduct
3. Uterus
4. Cervix
5. Vagina
6. External genitalia
7. A pair of mammary gland



Secondary sex organ

OVARIES

- It is primary female sex organ which produce the female gamete(ovum)
- Also produces several steroids hormones.
- Located in lower abdomen
- Each ovary is about 2-4 cm in length
- Connected to the pelvic and uterus by ligaments
- Each ovary covered by thin epithelium which encloses the ovarian stroma.
- Ovarian stroma has 2 zones – 1) A peripheral cortex
2) An inner medulla

OVIDUCT

- Oviduct (fallopian ducts), each fallopian tubes is about 10-12 cm long and extends from the periphery of each ovary to the uterus.
- Close to ovary the oviduct has a funnel shaped structure called INFUNDIBULUM.
- The edges of infundibulum possesses finger – like projections called FIMBRIAE, which helps in collection of ovum after ovulation.
- The infundibulum leads to the wider part of oviduct called AMPULLA.
- The last part of oviduct is called ISTHMUS which joined to uterus.

UTERUS

- It is single and is called **womb**. It is **inverted pear shaped**. Attached to the pelvic by ligaments.
- The uterus opens into vagina through a narrow cervix. The cavity of the cervix is called cervical canal which along with vagina forms the **birth canal**.
- The wall of the uterus has three layers of tissue.
 1. Perimetrium- The external thin membranous
 2. Myometrium- middle thick layer of smooth muscle, undergoes strong contraction at time of birth.
 3. Endometrium- inner glandular layer, undergoes cyclic changes during menstrual cycle.

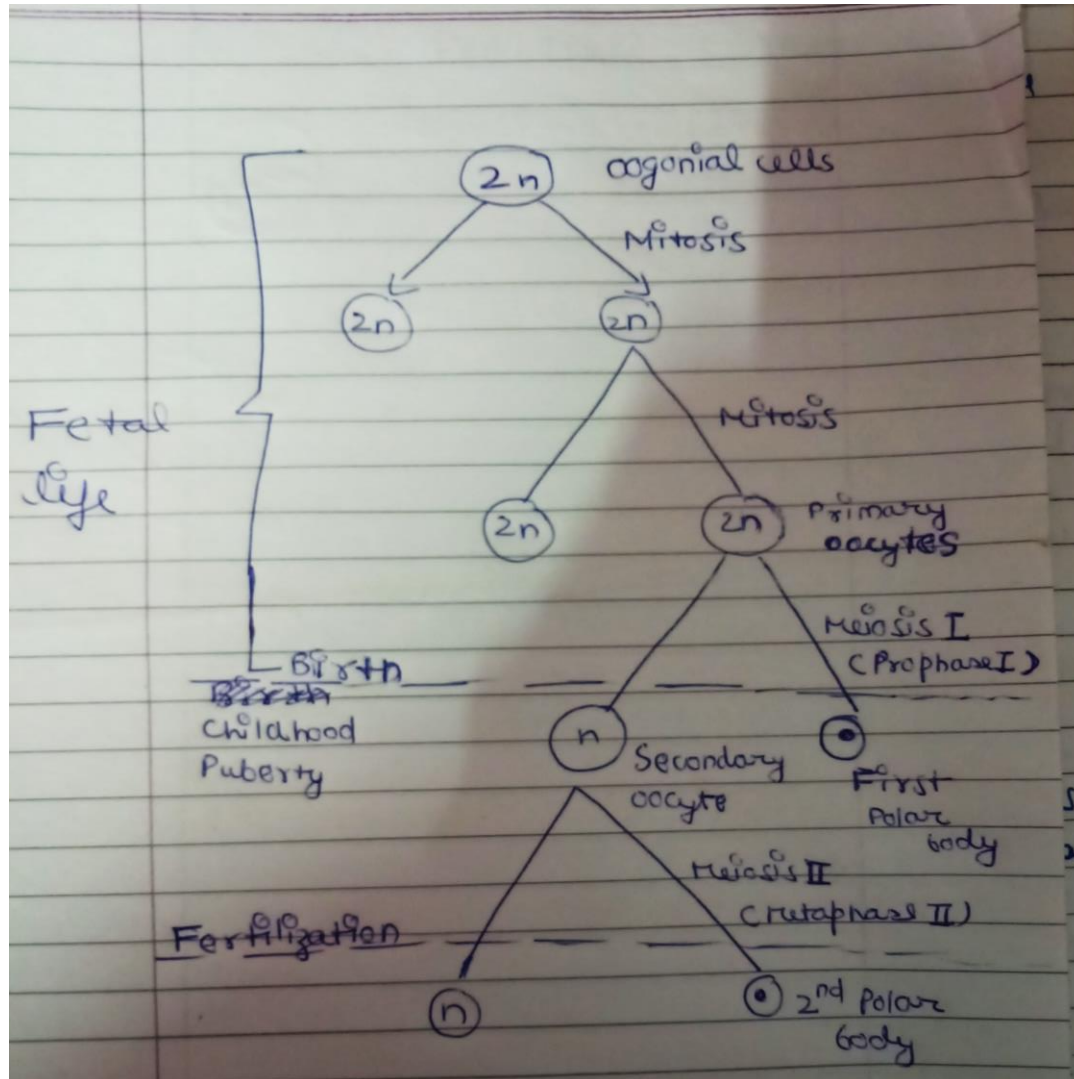
External genitalia

- The female external genitalia include
- **Mons pubis**- is a cushion of fatty tissue covered by skin and pubic hair.
- **Labia majora**- fleshy folds of tissue, which extend down from the mons pubis and surround the vaginal opening.
- **Labia minora**- paired folds of tissue under the labia majora
- **Hymen**- The opening of the vagina is often covered partially by a membrane called hymen
- **Clitoris**- Is a tiny finger-like structure which lies at the upper junction of the two labia minora above the urethral opening.

Mammary gland

- The mammary glands are paired structures (breasts) that contain glandular tissue and variable amount of fat.
- glandular tissue of each breast is divided into 15-20 **mammary lobes**.
- mammary lobes containing clusters of cells called **alveoli** (cells of alveoli secrete milk, which is stored in the cavities (lumens) of alveoli)
- alveoli open into **mammary tubules**.
- tubules of each lobe join to form a **mammary duct**.
- Several mammary ducts join to form a wider **mammary ampulla**.
- Several mammary ducts join to form a wider mammary ampulla which is connected to **lactiferous duct**, through which milk is sucked out.
- **SEE FIG NO 3.4 PAGE NO 46 IN NCERT**

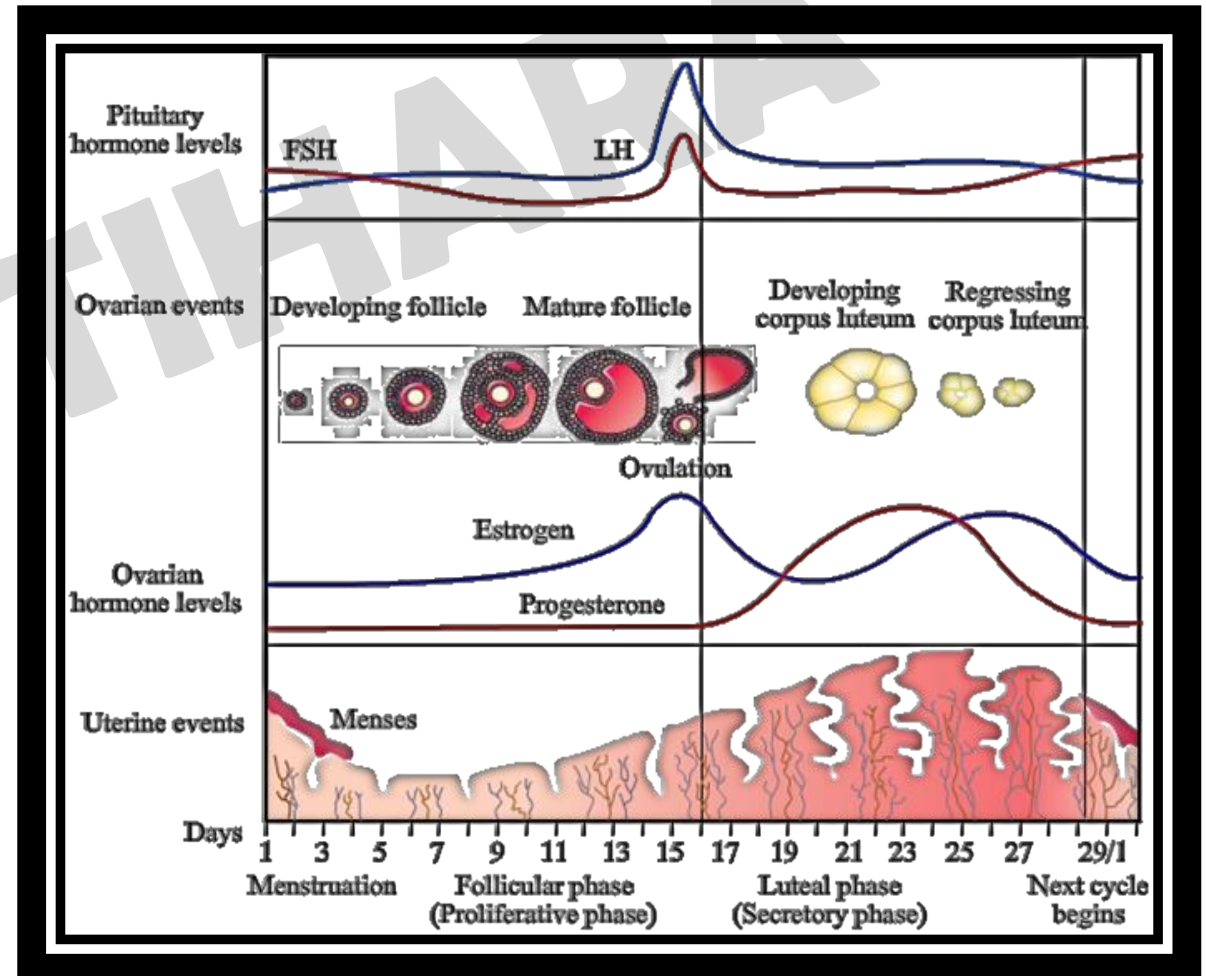
O O G E N E S I S



Draw this when come in exam.

MENSTRUAL CYCLE

- The reproductive cycle in the female primates (e.g. monkeys, apes and human beings) is called menstrual cycle.
- The first menstruation begins at puberty and is called menarche.
- menstruation is repeated at an average interval of about 28/29 days, and the cycle of events starting from one menstruation till the next one is called the menstrual cycle.
- One ovum is released (ovulation) during the middle of each menstrual cycle.
- Phases in menstrual cycle-
 1. Menstrual phase (1-5 days)
 2. Follicular phase/proliferative phase (5-13 days)
 3. Ovulatory phase (14th day)
 4. Luteal phase/ secretory phase (15-28 days)



Menstrual phase

- 1st phase of menstrual cycle
- It lasts for 3-5 days.
- breakdown of endometrial lining of the uterus and its blood vessels.
- Mucus and blood comes out through vagina.
- Lack of menstruation is indication of pregnancy.

Follicular phase

- 2nd phase of menstrual cycle.
- the primary follicles in the ovary grow to become a fully mature Graafian follicle
- Regeneration and proliferation of uterine endometrium.
- The secretion of gonadotropins (LH and FSH) increases gradually during the follicular phase.
- Level of estrogen increases as it is secreted from growing follicle.
- It lasts for 5-13 days.

Ovulatory phase

- LH and FSH attain a peak level in this period of cycle.
- Rapid secretion of LH leading to its maximum level during the mid-cycle called **LH surge** induces rupture of Graafian follicle and thereby the release of ovum (ovulation)

Luteal phase

- Remaining parts of the Graafian follicle transform as the corpus luteum.
 - The corpus luteum secretes large amounts of progesterone which is essential for maintenance of the endometrium. Which is necessary for implantation of the fertilized ovum and other events of pregnancy.
 - Thickness of uterine endometrium increases many folds due to proliferation.
 - In absence of fertilization, corpus luteum degenerates.
 - Disintegration of endometrium leading to menstruation.
-
- **Menstrual cycle ceases around 50years of age, called menopause.**

FERTILIZATION AND IMPLANTATION.

- During copulation (coitus) semen is released by the penis into the vagina (insemination). The motile sperms swim rapidly, pass through the cervix, enter into the uterus and finally reach the junction of the isthmus and ampulla (ampullary-isthmic junction) of the fallopian tube.
- The ovum released by the ovary is also transported to the ampullary-isthmic junction where fertilisation takes place.
- Fertilisation can only occur if the ovum and sperms are transported simultaneously to the ampullary-isthmic junction. **This is the reason why not all copulations lead to fertilisation and pregnancy.**
- The process of fusion of a sperm with an ovum is called fertilisation.
- During fertilisation, a sperm comes in contact with the zona pellucida layer of the ovum and induces changes in the membrane that block the entry of additional sperms.
- That ensure monospermy and prevents polyspermy.
- Entry of sperm into ovum induces the completion of the meiotic division of the secondary oocyte.
- The second meiotic division is also unequal and results in the formation of a second polar body and a haploid ovum (ootid).
- haploid nucleus of the sperms and that of the ovum fuse together to form a diploid zygote($2n$).

Cleavage.

- The mitotic division starts as the zygote moves through the isthmus of the oviduct called cleavage towards the uterus.
- Daughter cells produced during cleavage are called blastomere.
- The embryo with 8 to 16 blastomeres is called a morula. The morula continues to divide and transforms into blastocyst as it moves further into the uterus.
- The blastomeres in the blastocyst are arranged into an outer layer called trophoblast and an inner group of cells attached to trophoblast called the inner cell mass.
- The trophoblast layer then gets attached to the endometrium helps in development of placenta.
- The inner cell mass gets differentiated into the embryo.
- After attachment, the uterine cells divide rapidly and covers the blastocyst.
- the blastocyst becomes embedded in the endometrium of the uterus. This is called implantation and it leads to pregnancy.

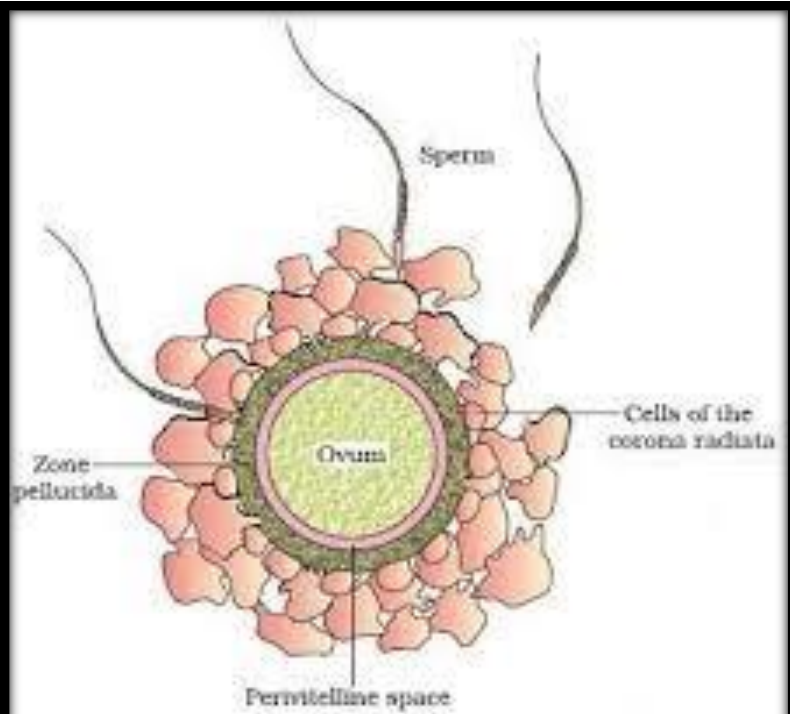
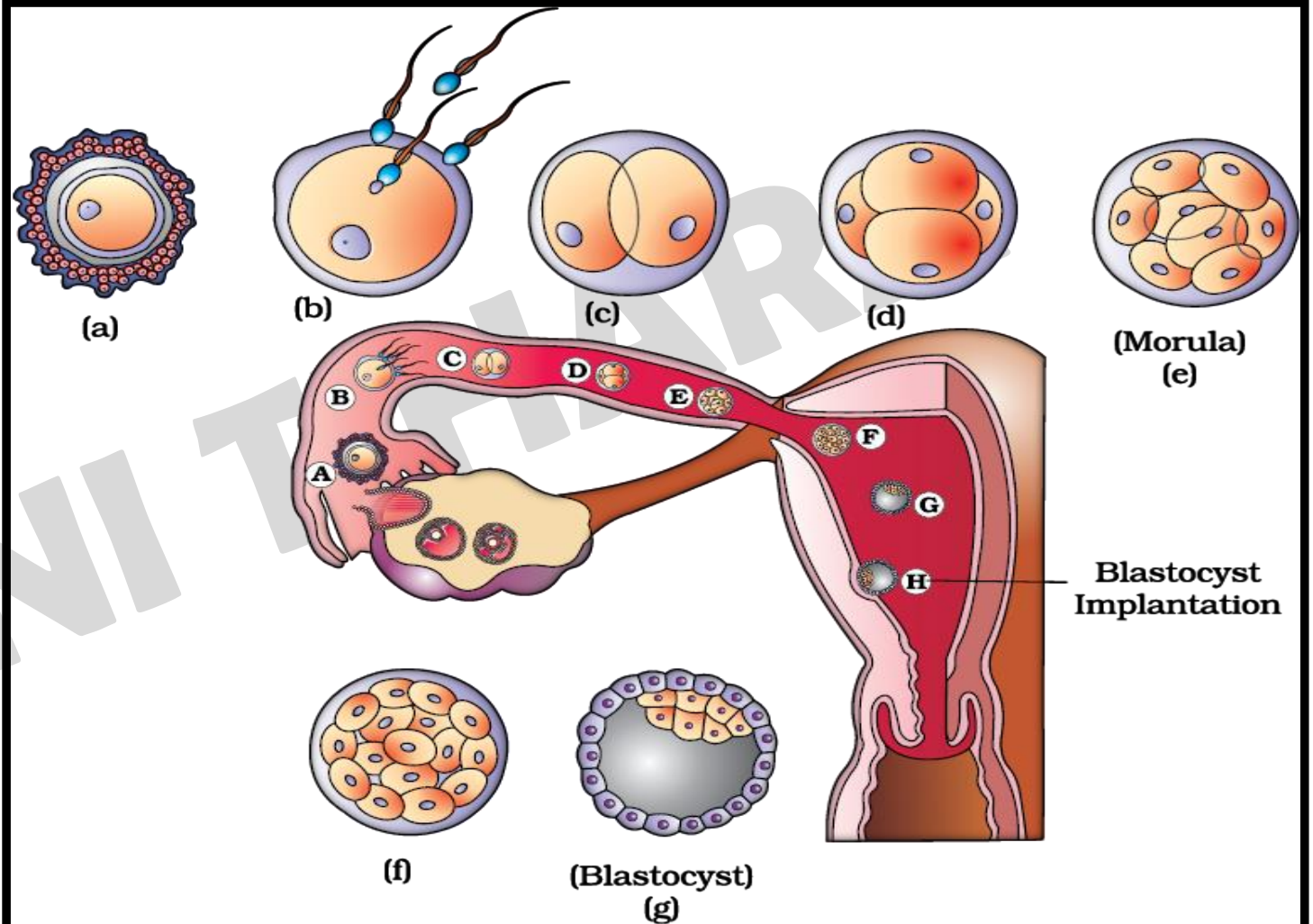


Figure 10. Ovum surrounded by few sperms



PREGNANCY AND EMBRYONIC DEVELOPMENT

- After implantation, finger-like projections appear on the trophoblast called chorionic villi which are surrounded by the uterine tissue and maternal blood.
- Temporary association between the fetal tissue (chorionic villi) and maternal tissue (uterine endometrium) is called PLACENTA.

❑ FUNCTION OF PLACENTA

- The placenta is connected to the embryo through an umbilical cord which helps in the transport of substances to and from the embryo.
- facilitate the supply of oxygen and nutrients to the embryo and also removal of carbon dioxide and excretory/waste materials produced by the embryo.
- Placenta also acts as an endocrine tissue and produces several hormones like-
 1. **human chorionic gonadotropin (hCG)**
 2. **human placental lactogen (hPL)**
 3. **estrogens**
 4. **progestogens**
 5. In the later phase of pregnancy, a hormone called relaxin is also secreted by the ovary.

Embryonic development

- After implantation, the inner cell mass (embryo) differentiates into an outer layer called ectoderm and an inner layer called endoderm.
- A mesoderm soon appears between the ectoderm and the endoderm.
- The inner cell mass contains certain cells called stem cells which have the potency to give rise to all the tissues and organs.

Organogenesis

- Formation of different organs in embryo is called organogenesis.
- Human pregnancy lasts 9 months.
- After one month of pregnancy, the embryo's heart is formed.
- By the end of the second month of pregnancy, the foetus develops limbs and digits.
- By the end of 12 weeks (first trimester), most of the major organ systems are formed, for example, the limbs and external genital organs are well-developed.
- The first movements of the foetus and appearance of hair on the head are usually observed during the fifth month.
- By the end of 24 weeks (second trimester), the body is covered with fine hair, eye-lids separate, and eyelashes are formed.
- By the end of nine months of pregnancy, the foetus is fully developed and is ready for delivery.

Parturition and lactation.

- The period of human pregnancy is about 9 months which is called the gestation period.
- Process of delivery of the foetus (childbirth) is called parturition.
- Vigorous contraction of the uterus(myometrium) at the end of pregnancy causes expulsion/delivery of the foetus.
- The signals for parturition originate from the fully developed fetus and the placenta which induce mild uterine contractions called foetal ejection reflex.
- triggers release of oxytocin from the maternal pituitary. Oxytocin acts on the uterine muscle and causes stronger uterine contractions, which in turn stimulates further secretion of oxytocin. The **stimulatory reflex between the uterine contraction and oxytocin secretion** continues resulting in stronger and stronger contractions. This leads to expulsion of the baby out of the uterus through the birth canal – parturition. Soon after the infant is delivered, the placenta is also expelled out of the uterus.
- LACTATION
- The mammary glands of the female undergo differentiation during pregnancy and starts producing milk towards the end of pregnancy by the process called lactation.
- milk produced during the initial few days of lactation is called **colostrum** which contains several antibodies(IgA) absolutely essential to develop resistance for the new-born babies and is yellowish in color.