

UNIT – V HUMAN REPRODUCTIVE SYSTEM

VA-HUMAN REPRODUCTIVE SYSTEM

Very Short Answer Questions

1. **Where are the testes located in man? Name the protective coverings of each testis.**

A. Testes are the male primary sex organs and located outside the abdominal cavity in a pouch named as 'scrotum'.

Each testis is enclosed in a fibrous envelope known as 'tunica albuginea' and outer 'tunica vaginalis'.

2. **Name the canals that connect the cavities of scrotal sac and abdominal cavity. Name the structures that keep the testes in position?**

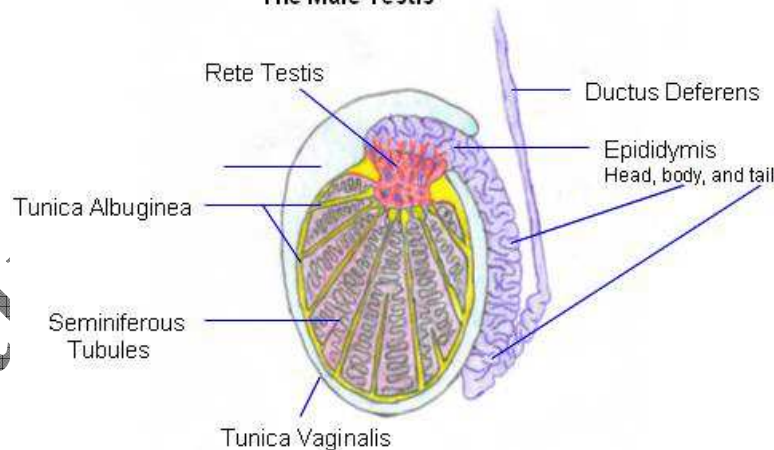
A. The cavity of scrotal sac is connected to the abdominal cavity through the 'inguinal canal'.

Testes are held in position in the scrotum by

a) 'Gubernaculum', a fibrous cord that connects testis with the bottom of scrotum.

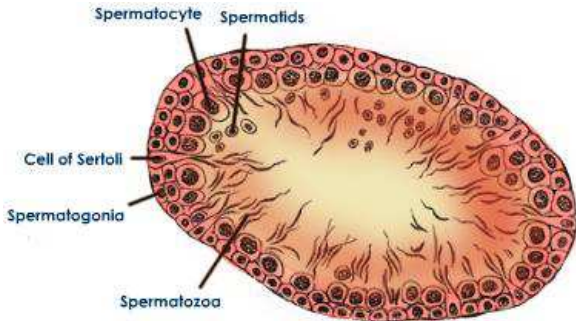
b) 'Spermatic cord' formed by vas deferens, nerves, blood vessels and other tissues.

The Male Testis



3. What are the functions of Sertoli cells of the seminiferous tubules and the Leydig cells in man?

A. i) **Sertoli cells** : Also known as ‘nourishing cells’ helps in the nourishment of spermatozoa and produce a hormone ‘inhibin’, which inhibits the secretion of FSH.



ii) **Leydig cells**: Produce testosterone that controls the secondary sexual characters and spermatogenesis.

4. Name the copulatory structure of man. What are the three columns of tissues in it?

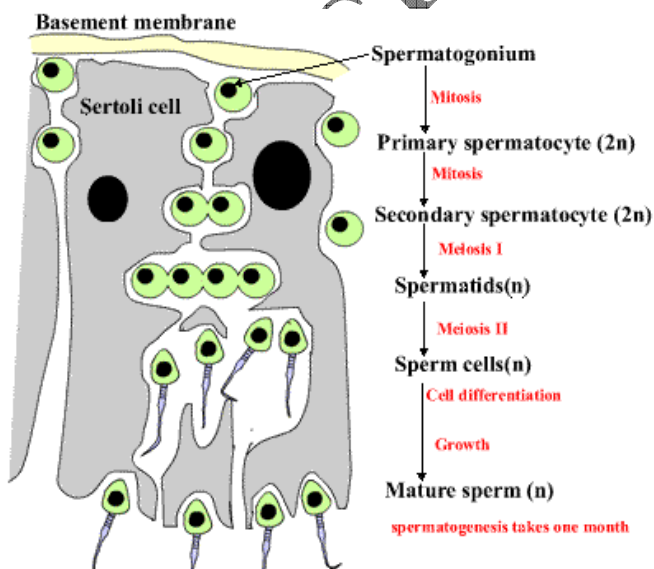
A. The penis is the copulatory structure in man.

It is made up of the three columns of tissue. They are: Two upper ‘Corpora **Cavernosa**’ on the dorsal side and one ‘**Corpus Spongiosum**’ on the ventral side.

5. Define Spermiogenesis and Spermiation?

A. **Spermiogenesis** : Transformation of haploid spermatids into spermatozoa or sperms.

Spermiation: The process in which sperm head becomes embedded in the Sertoli cells and finally released from the seminiferous tubules.



6. What are the four extra embryonic membranes?

A. The four extra embryonic membranes are

- a) Chorionic Membrane
- b) Amniotic Membrane
- c) Allantoic Membrane
- d) Yolk sac

7. Define gestation period. What is the duration of gestation period in the human beings?

A. Pregnancy is the intra uterine development of the embryo or foetus. It is also called as gestation period.

In humans the gestation period is 266 days (38 weeks) from the fertilization of egg or 40 weeks from the start of last menstrual cycle.

8. What is implantation with reference to embryo?

A. The trophoblast of blastocyst invades the endometrium of uterus and get implanted into the uterine mucosa till the whole of it comes to lie within the thickness of the endometrium. It is called as interstitial implantation. It begins on the 6th day after fertilization. It is aided by proteolytic enzymes formed by the trophoblast.

9. Distinguish between hypoblast and epiblast.

A.

Hypoblast	Epiblast
It is formed by the delamination of cells from the lower part of The cell layer on the inner embryonic disc It forms the future extra embryonic endoderm	After delamination, the remaining part of the embryonic disc of blastocyst is called epiblast

10. Write two major functions each of testis and ovary?

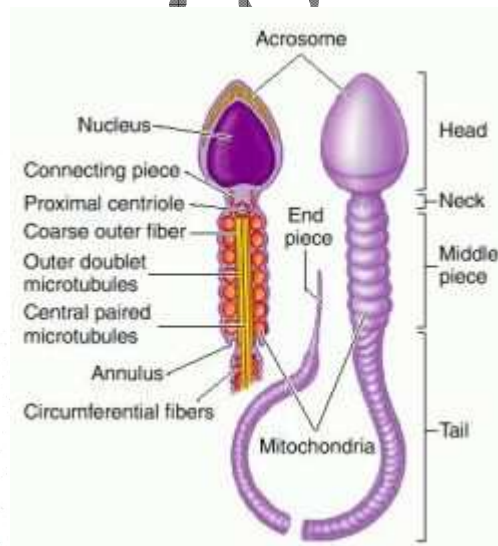
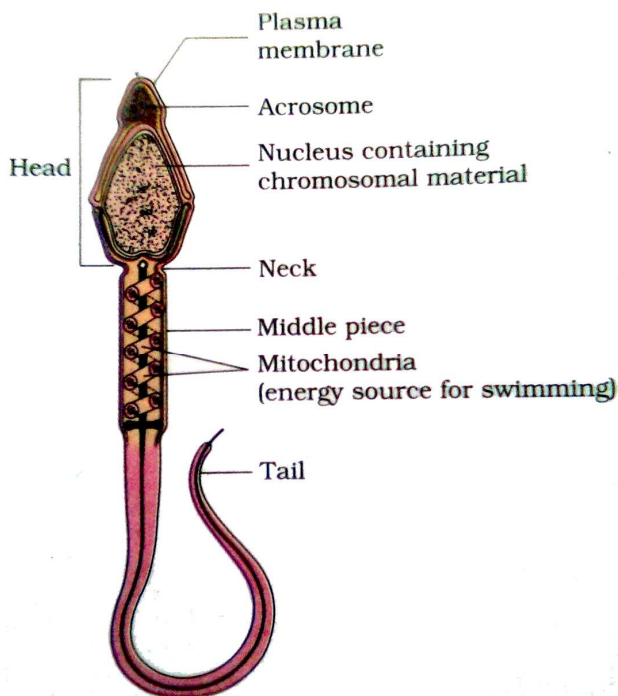
A. Functions of Testis:

- a) Testis produces sperms.
- b) Leydig cells of testes produce a male sex hormone called 'Testosterone' which controls the development of secondary sexual characters and spermatogenesis.

Functions of Ovaries:

- a) Ovaries are primary female sex organs, producing an ovum during each menstrual cycle.
- b) They produce female hormones, Estrogen and Progesterone.

11. Draw a labelled diagram of a sperm?



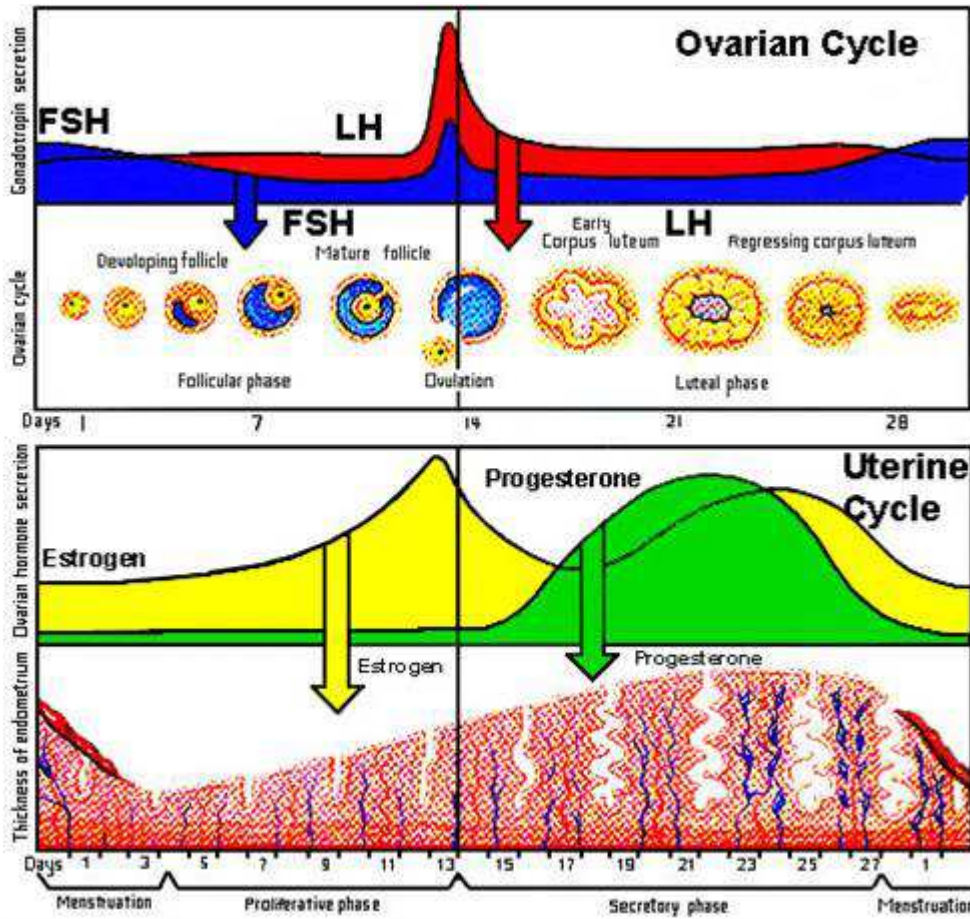
12. What are the major components of the seminal fluid?

- A. Seminal fluid is an alkaline, viscous fluid that contains fructose, proteins, citric acid, inorganic phosphorus, potassium and prostaglandins. It is produced by seminal vesicles present posteroinferior to the urinary bladder in the pelvis.

13. What is menstrual cycle? Which hormones regulate menstrual cycle?

- A. The reproductive cycle in the female primates like monkeys, apes and humans is called 'menstrual cycle'. The cycle is regulated by majority four hormones. They are:

- a) Luteinising hormone (LH),
- b) Follicular stimulating hormone (FSH)
- c) Estrogen &
- d) Progesterone.



14. What is parturition? Which hormones are involved in inducing parturition?

- A. The process of delivering of the foetus, starting from labour (a series of strong, rhythmic uterine contractions that push the foetus the placenta outside the body) is called parturition. **Oxytocin** is the hormone responsible for the contraction of uterus during parturition.

15. How many eggs do you think were released by the ovary of a female dog which gave birth to six puppies?

- A. The dog has produced single ovary but it might be fertilized by six different sperms. After fertilization, the synkaryon or zygotic nucleus undergoes divisions and forms six equal or unequal zygotes, those give birth to six puppies.

16. What is Neurulation?

A. Neurulation is the process of formation of neural tube from neural plate in embryo as part of organogenesis.

17. What is Capacitation of sperms?

A. Capacitation of sperm refers to the physiological changes that the spermatozoon undergoes to be able to penetrate and fertilize an egg.

18. What is compaction in human development?

A. The process in which morula becomes embryo by reducing unequal cleavage smaller and larger blastomeres and forming a superficial flat cell layer trophoblast and inner cell mass embryo proper.

19. Distinguish between involution and ingression in the human development.

A.

Involution	Ingression
It is the process by which future mesodermal cells converge through the primitive groove and reach epiblast and endoderm	It is the process in which future endodermal cells from the epiblast, replaces and forms the endoderm hypoblast of the embryo

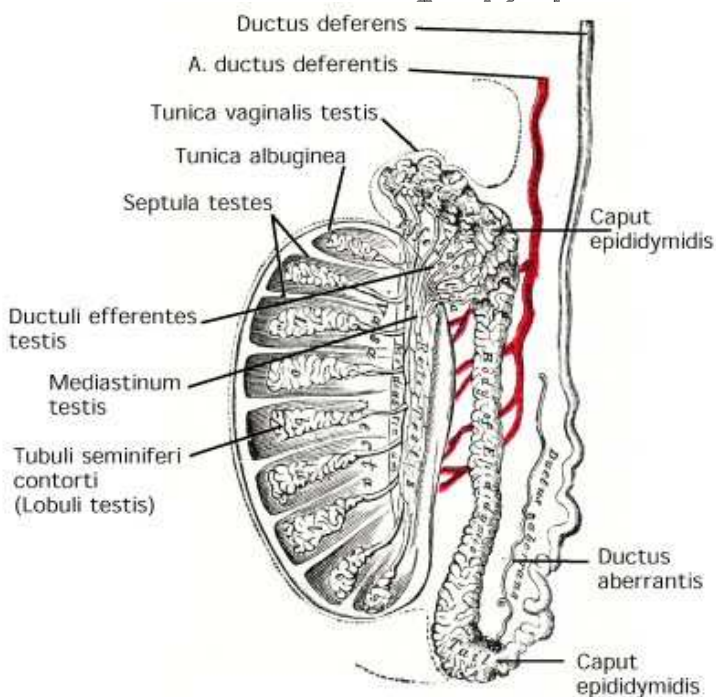
Short Answer Questions

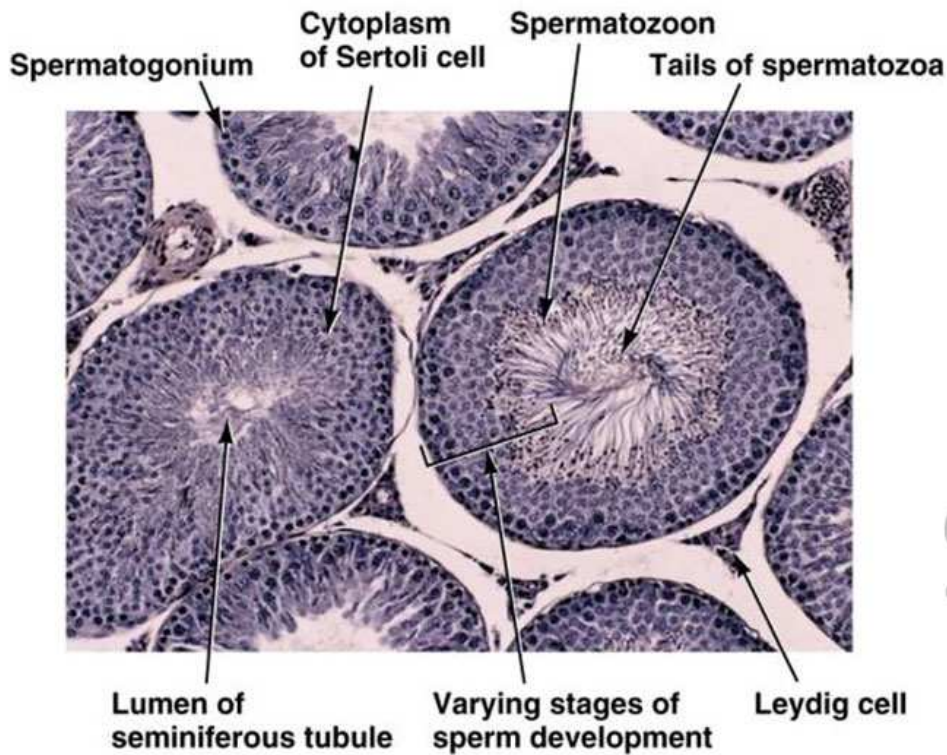
1. Describe microscopic structure of testis of man?

A. The testes or testicles are a pair of oval pinkish male primary sex organs suspended outside the abdominal cavity within a pouch called 'scrotum'. The low temperature ($2-2.5^{\circ}\text{C}$) is maintained in the scrotum to promote spermatogenesis.

Each testis is enclosed in a fibrous envelope, 'Tunica Albuginea'. The envelope extends inward to form septa that partition the testis into lobules. There are nearly 250 testicular lobules in each testis. Each lobule contains 1 to 3 highly coiled 'seminiferous tubules'. A pouch of serous membrane called 'tunica vaginalis' covers the testis.

Each seminiferous tubule is lined by 'germinal epithelium' which consists of undifferentiated male germ cells called 'spermatogonial mother cells' and nourishing cells called 'Sertoli cells'. These cells provide nutrition to spermatozoa and also produce inhibin that inhibits the secretion of FSH. The region outside the seminiferous tubules contains Leydig cells. These cells produce androgens; the most important is 'Testosterone'. It controls the development of secondary sexual characters and spermatogenesis. The seminiferous tubules open into 'vasa efferentia', through 'rete testis'. Rete testis is a network of tubules in the testis carrying spermatozoa from seminiferous tubules to vasa efferentia.

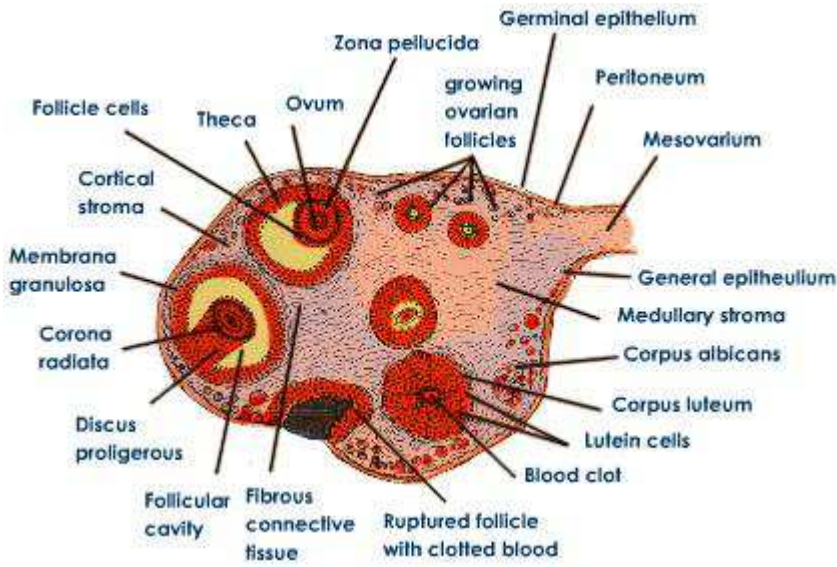
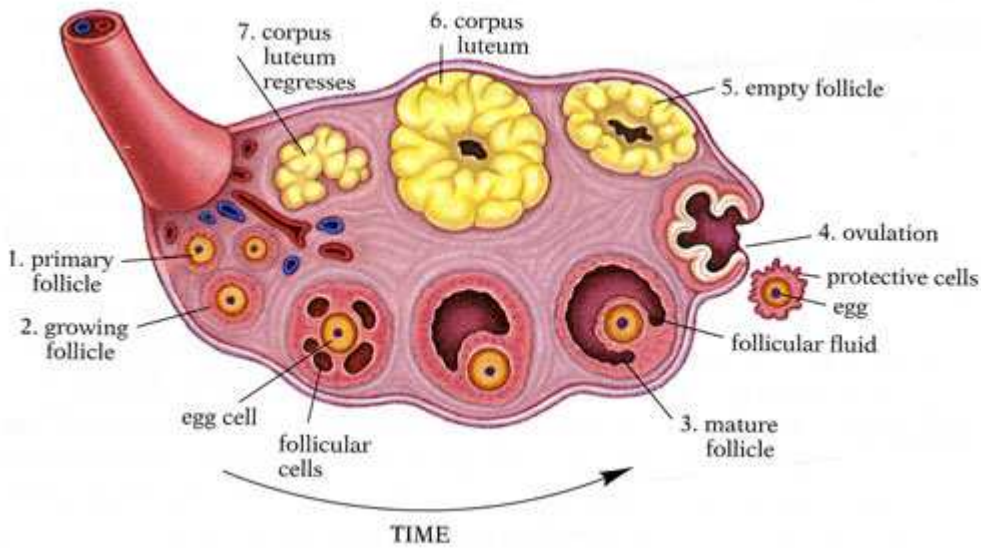




2. Describe the microscopic structure of ovary of woman?

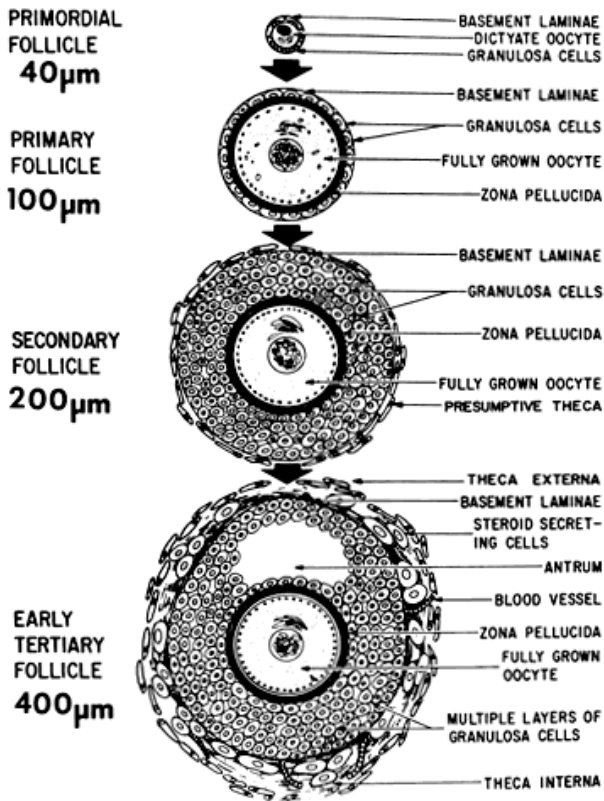
A. Ovaries are the primary female sex organs that produce the 'female gametes' or 'ova' and several steroid hormones (ovarian hormones). A pair of ovaries is located one on each side of the lower abdomen. The double layered fold of peritoneum connecting the ovary with the wall of abdominal cavity is known as the 'mesovarium'.

The ovaries are covered on the outside by a layer of simple cuboidal epithelium called 'germinal' (ovarian) epithelium. This is actually the visceral peritoneum that envelops the ovaries. Under this layer there is a dense connective tissue capsule, the 'tunica albuginea'. The ovarian stroma is distinctly divided into an outer cortex and an inner medulla. The cortex is dense and granular due to the presence of numerous ovarian follicles in various stages of development. The medulla is a loose connective tissue with abundant blood vessels, lymphatic vessels and nerve fibers.



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3. Describe the Graafian follicle in woman?

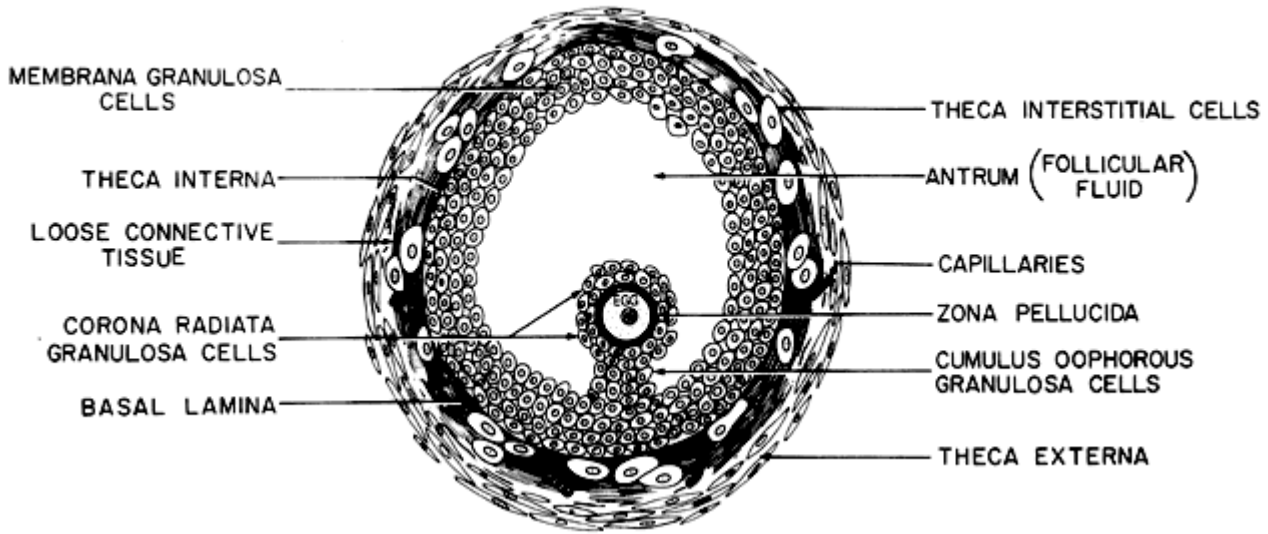
A. During 'oogenesis', the formed gametes mother cells or oogonia in each foetal ovary are called primary oocytes. Each primary oocyte gets surrounded by a flattened layer of follicular cells. It is called 'primordial follicle'. The follicles become cuboidal and proliferate to produce stratified epithelium made up of cells called granulose cells. Follicles at this stage of development are called 'primary follicles'. A homogenous membrane, the 'zona pellucida' appears between primary oocyte and granulose cells. The innermost layers of granulose cells are firmly attached to zona pellucida forming 'corona radiata'.

A cavity appears in membrane granulose, it increases in size, and wall of follicle becomes thin. As the follicle expands the stromal cells surrounding the granulose become condensed to form a covering called inner 'theca interna' and outer 'theca externa'. Now these follicles are called 'secondary follicles'.

The cells of theca interna secrete a hormone called Oestrogen. At this stage, the primary oocyte within the secondary follicles grows in size and completes 'meiosis I' forming a large haploid 'Secondary oocyte' and a small 'first polar body'. Then the 2nd meiotic division starts but stops at metaphase. The secondary follicle further changes into the nature

follicle called 'Graafian follicle'. The rupture of graafian follicle by LH results in the release of ovum, a process called ovulation.

HISTOLOGIC ARCHITECTURE OF GRAAFIAN FOLLICLE



4. Draw a labelled diagram of the male reproductive system?

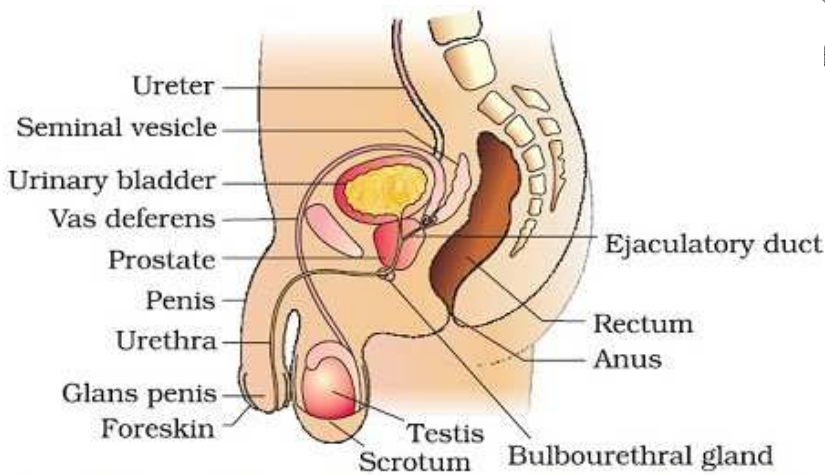


Figure 1(a). Diagrammatic sectional view of male pelvis showing reproductive system

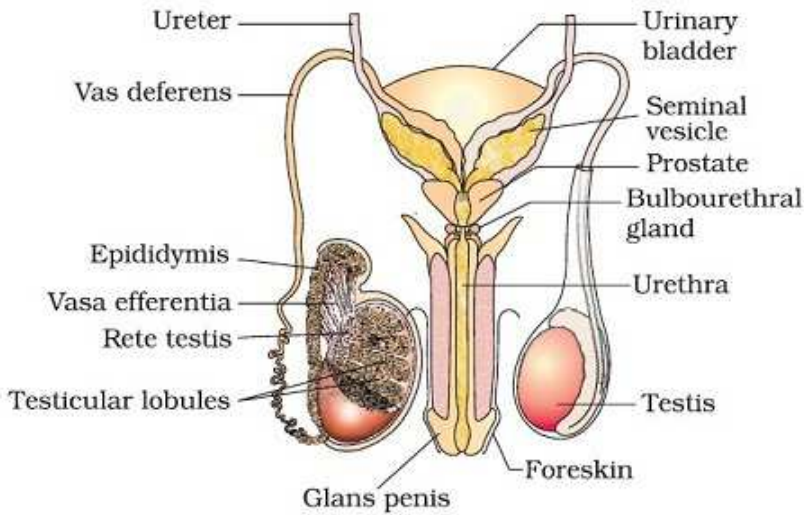
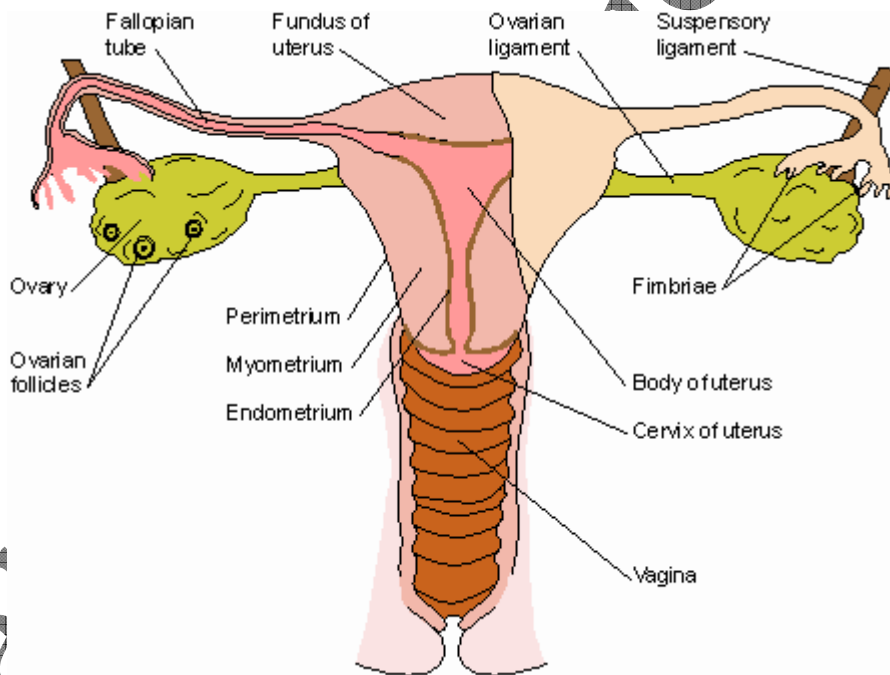


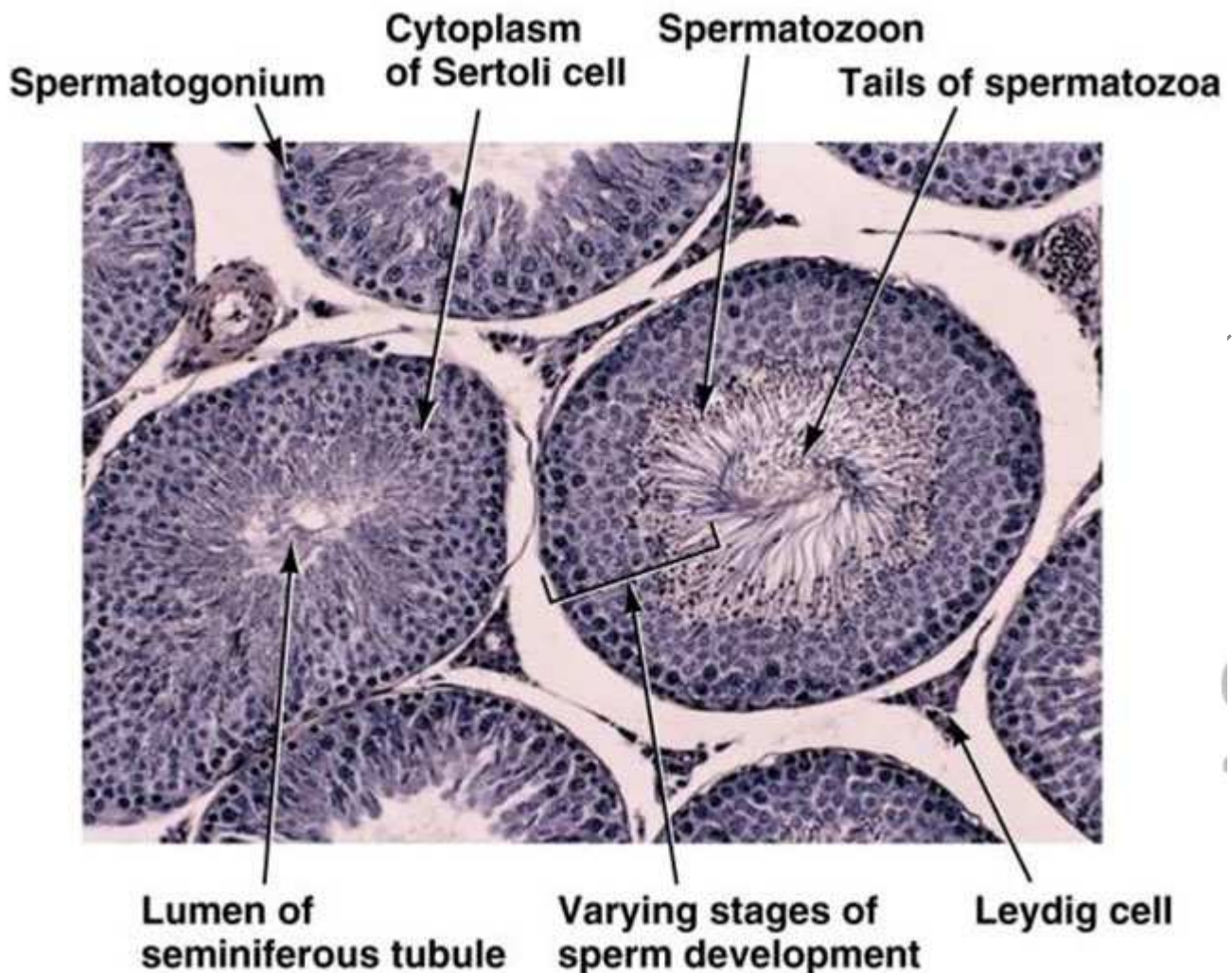
Figure 1(b). Diagrammatic view of male reproductive system (part of testis is open to show inner details)

5. Draw a labelled diagram of the female reproductive system?



6. Describe the structure of seminiferous tubule?

- A. Seminiferous tubules are present in the lobules of testes. Each seminiferous tubule is lined by the germinal epithelium which consists of undifferentiated male germ cells called spermatogonial mother cells and 'nourishing cells' called 'Sertoli cells'. The spermatogonia produce primary spermatocytes which undergo meiotic division finally leading to the formation of spermatozoa or sperms (spermatogenesis).



Sertoli cells provide nutrition to spermatozoa and produce a hormone 'inhibin' which inhibits the secretion of FSH. The regions outside the seminiferous tubules called interstitial spaces contain Leydig cells. Leydig cells produce androgens, mainly Testosterone that controls the development of secondary sexual characters and spermatogenesis. The seminiferous tubules open into 'vasa efferentia' through the 'Rete Testis'.

7. What is Spermatogenesis? Briefly describe the process of spermatogenesis in man.

- A. During puberty, in the testis the immature male germ cells, spermatogonia produce sperms by spermatogenesis. The spermatogonial stem cells in seminiferous tubules multiply by repeated mitotic divisions and develop into primary spermatocytes with 45 chromosomes. A primary spermatocyte undergoes first meiotic division to produce 2 equal sized haploid 'secondary spermatocyte' which have only 23 chromosomes. These undergo second meiotic division to produce four haploid 'spermatids' which in turn transform into spermatozoa

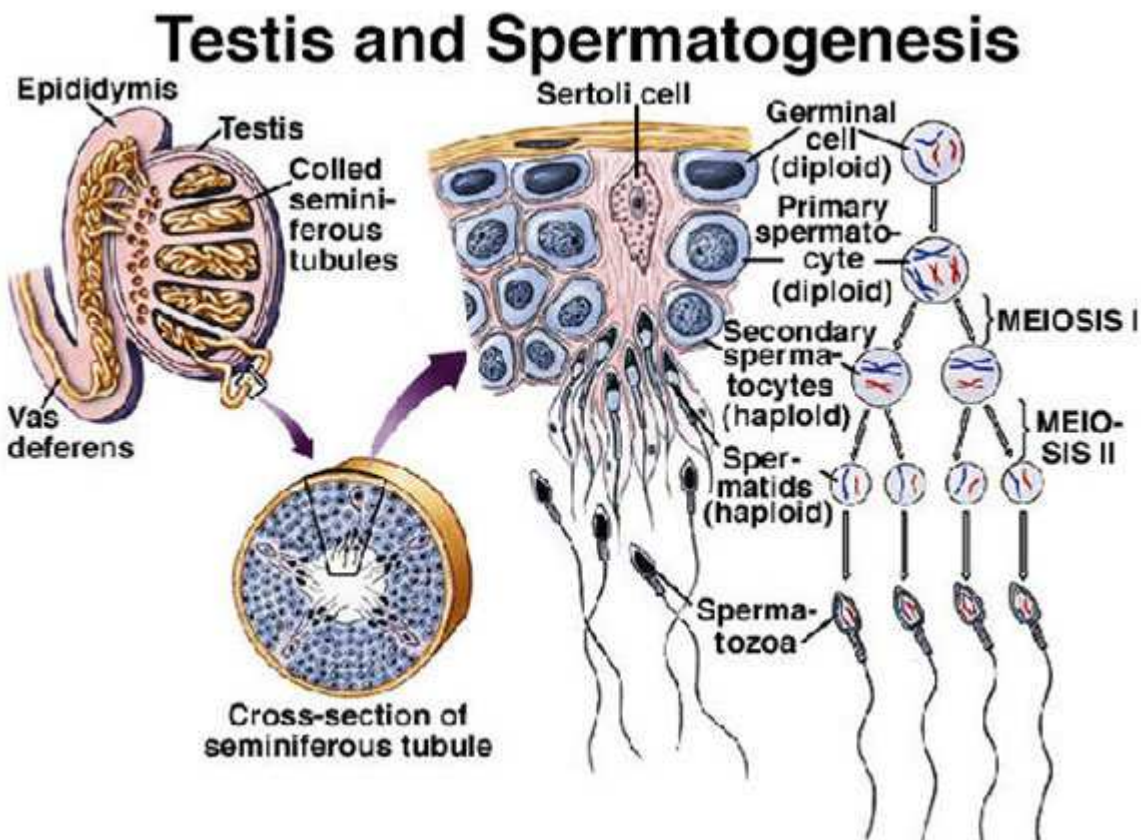
(sperms) by the process called spermiogenesis. After spermiogenesis, sperm heads become embedded in Sertoli cells, and are finally released from the seminiferous tubules by the process 'spermiation'.

Spermatogenesis starts at the age of puberty due to increase in the secretion of gonadotropin releasing hormone (GnRH), produced from hypothalamus. The increased levels of GnRH in turn stimulate pituitary gland to produce two gonadotropins.

a) Luteinizing Hormone (LH)

b) Follicular Stimulating Hormone (FSH)

LH acts as Leydig cells and stimulates the secretion of androgens. Androgens in turn stimulate the process of spermatogenesis. FSH acts on sertoli cells and stimulates secretion of some factors which help in the process of Spermiogenesis.



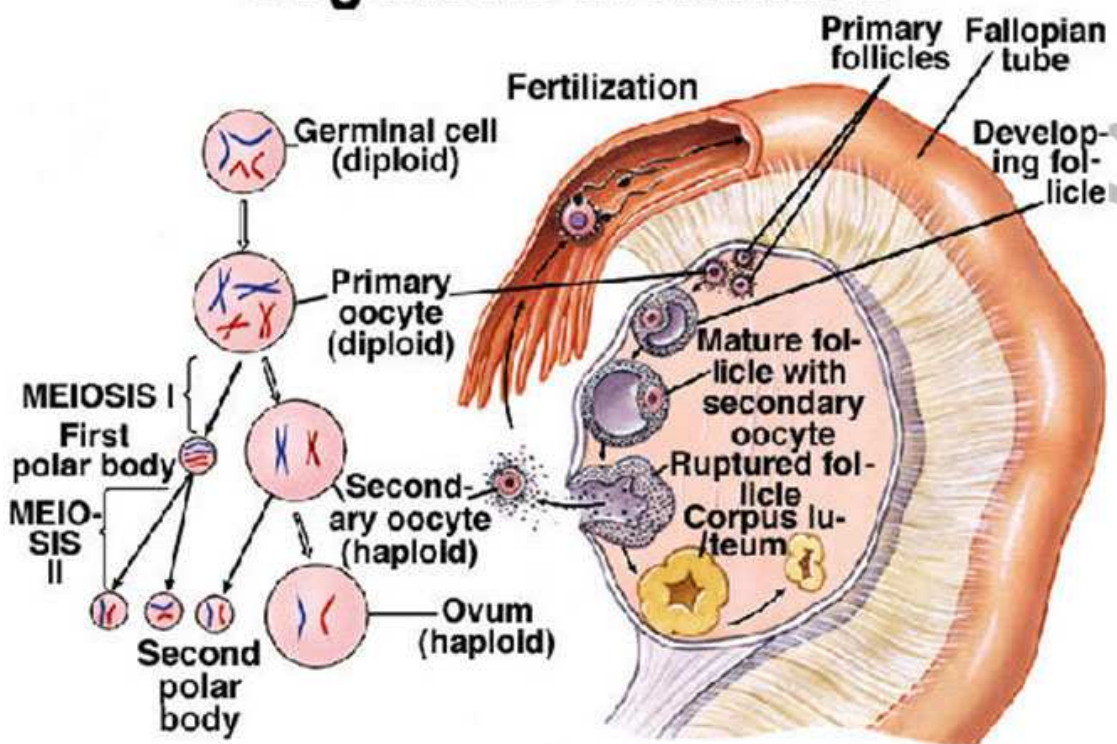
8. What is Oogenesis? Give a brief account of Oogenesis in a woman?

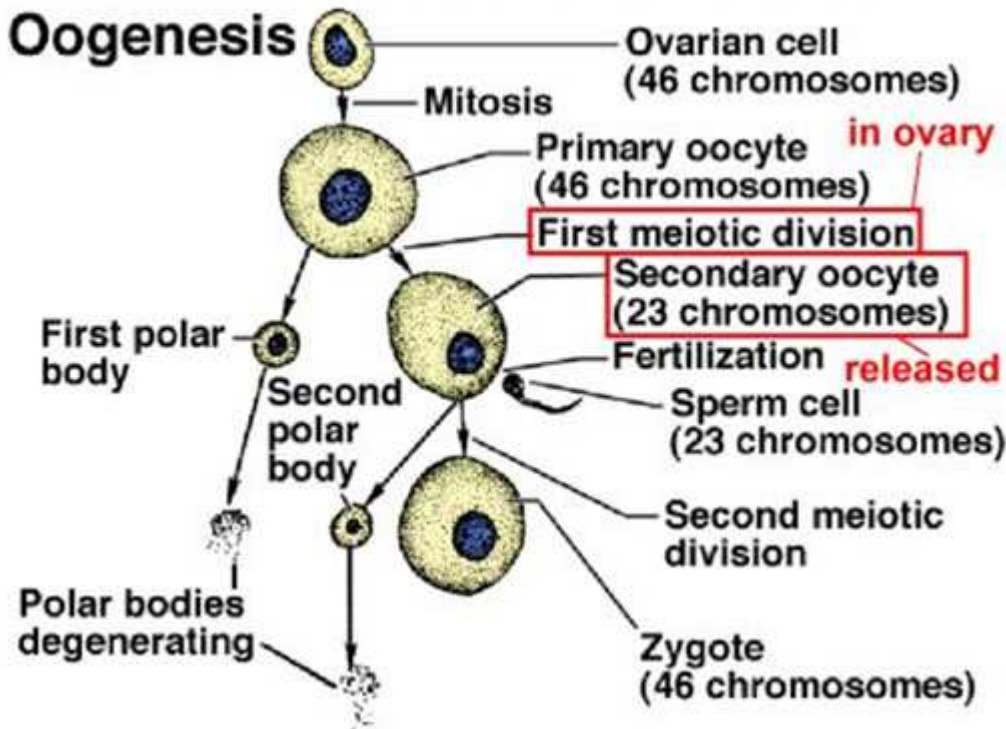
A. The process of formation of mature female gametes is called 'Oogenesis'. It is initiated during the embryonic development stage when a couple of million gamete mother cells (oogonia) are formed within each foetal ovary and do not multiply thereafter. These cells start division and stop the process at prophase I of the meiosis – I. At this stage they are called primary oocytes.

Each primary oocyte is surrounded by a flattened layer of follicular cells, it is called primary follicle. These follicular cells become cuboidal and proliferate to produce a stratified epithelium called membrane granulosa. These cells are called granulosa cells. Follicles at this stage are called primary follicles. A homogenous membrane, the 'zona pellucida' appears between primary oocyte and granulosa cells.

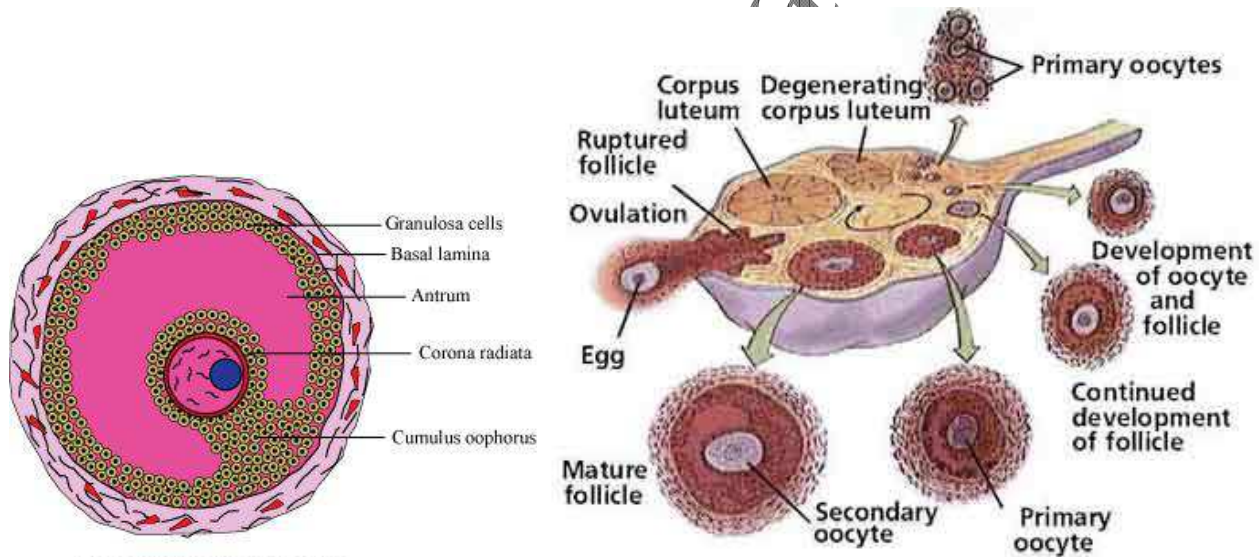
A cavity appears within the membranous granulosa increases in size and the wall of follicle becomes thin. The oocyte lies eccentrically in the follicle surrounded by granulosa cells. As the follicle expands the stromal cells surrounding membrane granulosa become condensed to form a covering 'theca interna' and outer covering 'theca externa'. Now these are called 'secondary follicles'. The cells of theca interna later secrete a hormone called 'oestrogen'. The primary oocyte within the graafian undergoes two meiotic divisions, finally changing into a 'Graafian follicle'. The Graafian follicle is at first very small, it enlarges, becomes so big that it not only reaches the surface of ovary, but also forms a bulging in this situation. Ultimately the follicle ruptures releasing the ovum.

Oogenesis in Humans

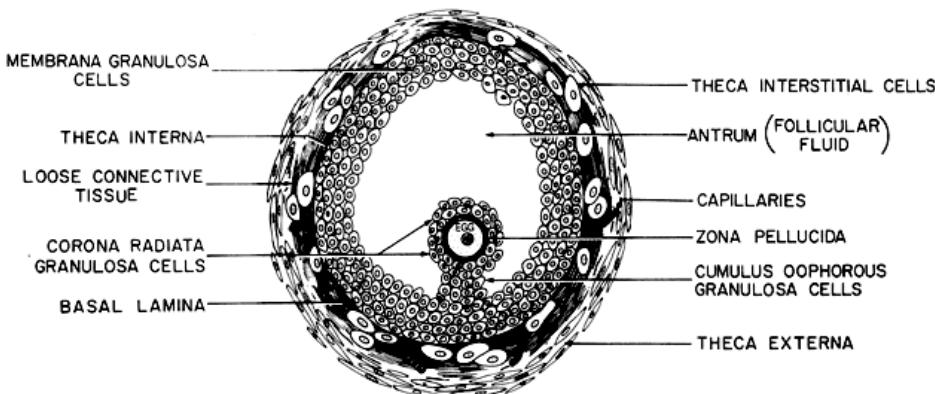




9. Draw a labelled diagram of Graafian follicle?



HISTOLOGIC ARCHITECTURE OF GRAAFIAN FOLLICLE



10. In our society women are often blamed for giving birth to daughters. Can you explain why this is not correct?

A. The sex of a child depends on the male parent but not on female parent. The sex of the baby has been decided at the time of fertilization itself. The chromosome pattern in human female is XX and that in the male is XY. Therefore all the haploid gametes produced by the female (ova) have the sex chromosome X, whereas the male gametes (sperms) have either X chromosome or Y chromosome. 50 percent of sperms carry the X chromosome while the other 50 percent carry the Y chromosome.

After fusion of the male and female gametes the zygote would carry either XX or XY depending on what type of sperm fertilized the ovum. The zygote carrying 'XX' would develop into a female child and that with XY would form a male child. So, the sex of a child depends on the male parent (heterogametic parent) but not on mother.

11. Describe the accessory glands associated with male reproductive system of man?

A. **The male accessory glands are:**

(a) Seminal Vesicles (b) Prostate Gland (c) Bulbourethral Glands

a) Seminal Vesicles: The seminal vesicles are a pair of simple tubular glands present posterior – inferior to the urinary bladder in the pelvis. Each seminal vesicle opens into corresponding vas deferens thus enters into prostate gland. The secretion of the seminal vesicles constitutes about 60 percent of the volume of seminal fluid. It is an alkaline, viscous fluid that contains fructose, proteins, citric acid, inorganic phosphorus, potassium and prostaglandins. Fructose is main energy source for the sperm and prostaglandins aid fertilization by causing mucous lining of the cervix to be more receptive to sperm as well as by aiding the movement of sperm towards the ovum.

b) Prostate Gland: Prostate gland is located directly beneath the urinary bladder. The gland surrounds the 'prostatic urethra' and sends its secretions through several prostatic ducts. In man, the prostate contributes 15 – 30 percent of the semen. The prostate secretion activates spermatozoa and provides nutrition.

c) Bulbourethral Glands: They are also called 'Cowper's glands' are located beneath the prostate gland at the beginning of the internal portion of the penis. They add an alkaline fluid to semen during the process of ejaculation. The fluid secreted by these glands

lubricates the urethra. It also functions as a flushing agent that washes out the acidic urinary residues that remain in urethra, before the semen is ejaculated.

12. Describe the placenta in a woman?

A. Placenta is a structural and functional unit of both chorionic villi and uterine tissue and it develops between the embryo (foetus) and the mother. The maternal and foetal bloods do not mix with each other. They are separated by the placental membrane.

The placenta consists of two essential portions: a maternal part of the placenta derived from the endometrium of the uterus and foetal membranes of the foetal part of the placenta.

The maternal components of the placenta are:

- a) Uterine epithelium
- b) Uterine connective tissue
- c) Uterine capillary epithelium

The foetal components of the placenta are:

- a) Foetal capillary endothelium
- b) Foetal connective tissue
- c) Foetal chorionic epithelium

The placenta of human is called chorioallantoic placenta as allantois fuse with chorion in the process of vascularisation. Placenta is discoidal as the villi are restricted to the dorsal surface of blastodisc. Placenta is haemochorial as the maternal blood comes into direct contact with the foetal chorion. During parturition the placenta is cast off with the loss of embryonic membranes and the encapsulating maternal tissues (deciduas) causing extensive haemorrhage and there by bleeding. So, it is also called deciduate placenta.

Functions of Placenta:

1. Supplies oxygen and nutrients to the embryo.
2. Removes carbondioxide and excretory materials produced by embryo.
3. Secretes progesterone which is essential for maintenance of pregnancy after 4th month.
4. Secretes oestrogens (mainly estradiol) that reach maternal blood and promote uterine growth and development of mammary glands.
5. Secretes Human Chorionic Gonadotropin (HCG) that is similar to luteinizing hormone is its action. This hormone is also called used as indicator in the detection of pregnancy in early stages.

6. Somatomammotropin secreted by placenta has an anti – insulin effect on the mother leading to increased plasma levels of glucose and amino acids in the maternal circulation. In this way it increases the availability of these materials to the foetus.

Long Answer Questions

1. Describe female reproductive system of a woman with the help of labelled diagram?

A. The female reproductive system consists of a pair of ovaries along with a pair of oviducts, uterus, vagina and the external genitalia located in the pelvic regions. These parts of the system along with a pair of mammary glands are integrated structurally and functionally to support the processes of ovulation, fertilization, pregnancy, birth and child care.

1) Ovaries: Ovaries are the primary female sex organ that produces the female gametes (ova) and several steroid hormones (ovarian hormones). A pair of ovaries is located on each side of lower abdomen. The double layered fold of peritoneum connecting the ovary with the wall of abdominal cavity is known as the mesovarium.

The ovaries are covered by a layer of 'germinal (ovarian) epithelium'. Underneath this layer, there is dense connective tissue capsule called, 'Tunica Albuginea'. The ovarian stroma is distinctly divided into an outer cortex and an inner medulla. The cortex appears more dense and granular due to numerous ovarian follicles. The medulla is a loose connective tissue with abundant blood vessels, Lymphatic vessels and nerve fibres.

2) Fallopian Tubes (oviducts): Each fallopian tube extends from the periphery of each ovary to the uterus and it bears a funnel shaped infundibulum, with finger like projections called 'fimbriae', which help in collection of ovum called 'ovulation'. The infundibulum leads to a wider part of the oviduct called 'ampulla'. The last part of the oviduct, 'isthmus' has a narrow lumen and it joins the uterus. Fallopian tube is the site of fertilization. It conducts the ovum or zygote towards the uterus by peristalsis. The fallopian tube is attached to the abdominal wall by a peritoneal fold called 'mesosalpinx'.

3) Uterus: The uterus is a single and it is also called womb. It is a large, muscular, highly vascular and inverted pear – shaped structure present in the pelvis between the bladder and rectum. The lower narrow part through which the uterus opens into the vagina is called 'cervix'. The cavity of the cervix is called 'cervical canal' which along with the vagina forms the 'birth canal'.

The wall of the uterus has three layers of tissue. The external thin membranous 'perimetrium', the middle thick layer of 'myometrium' and inner glandular lining layer called 'endometrium'. The endometrium undergoes cyclic changes during menstrual cycle while myometrium exhibits strong contractions during parturition.

d) Vagina: The vagina is a large, median, fibro muscular tube that extends from the cervix to the vestibule (the space between labia minora). It is lined by non – keratinized stratified squamous epithelium. It is a highly vascular and opens into the vestibule by the vaginal orifice.

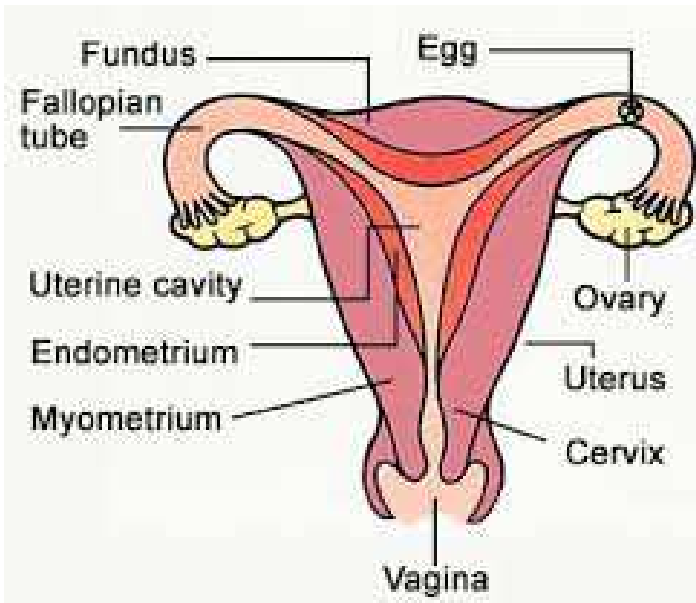
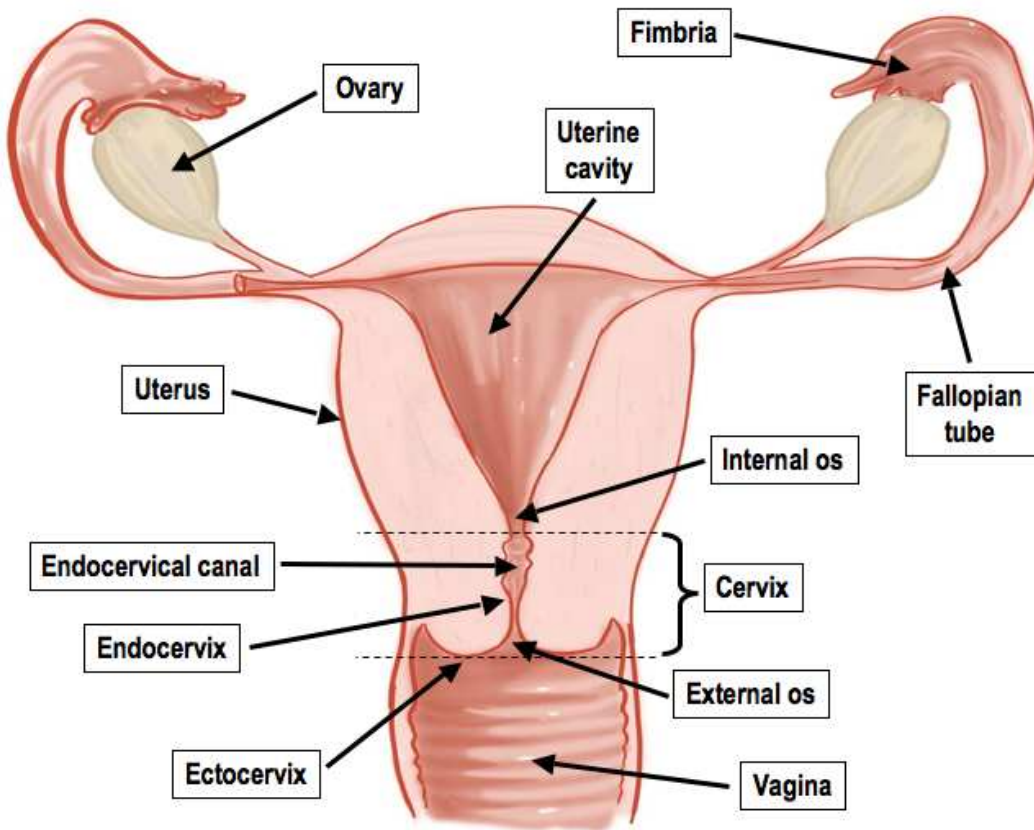
5) Vulva: Vulva or pudendum refers to the external genitals of the female. The vestibule has two apertures – the upper external urethral orifice of the urethra and the lower vaginal orifice of vagina. Vaginal orifice is covered by a mucous membrane 'hymen'. Vestibule is bound by two pairs of fleshy folds of tissue called inner 'labia minora' and outer larger 'labia majora'. Clitoris is a sensitive, erectile structure that lies at the upper junction of the two labia minor above the urethral opening. There is a cushion of fatty tissue covered by skin and pubic hair present above the labia major, called mons pubis.

Accessory reproductive glands of female: These include:

a) Bartholin's Glands: These are two glands located slightly posterior and to the left and right of the opening of the vagina. They secrete mucus to lubricate the vagina and are homologous to the bulbourethral glands of the male reproductive system.

b) Skene's Glands: These are located on the anterior wall of vagina, around the lower end of the urethra. They secrete a lubricating fluid when stimulated. The skene's glands are homologous to the prostate gland of the male reproductive system.

c) Mammary Glands: These are paired structures that contain glandular tissue and fat. The alveoli cells present in the mammary lobes of each glandular tissue secrete milk, which is stored in cavities of alveoli. The alveoli open into mammary tubes and then to mammary ducts, from there to mammary ampulla and finally connected to lactiferous duct through which milk is sucked out by the baby.



2. Describe male reproductive system of a man. Draw a labelled diagram of it?

A. The male reproductive system or male genital system consists of a number of sex organs that are a part of the human reproductive system. The sex organs which are located in the pelvic region include a pair of testes, accessory ducts, glands and external genitalia.

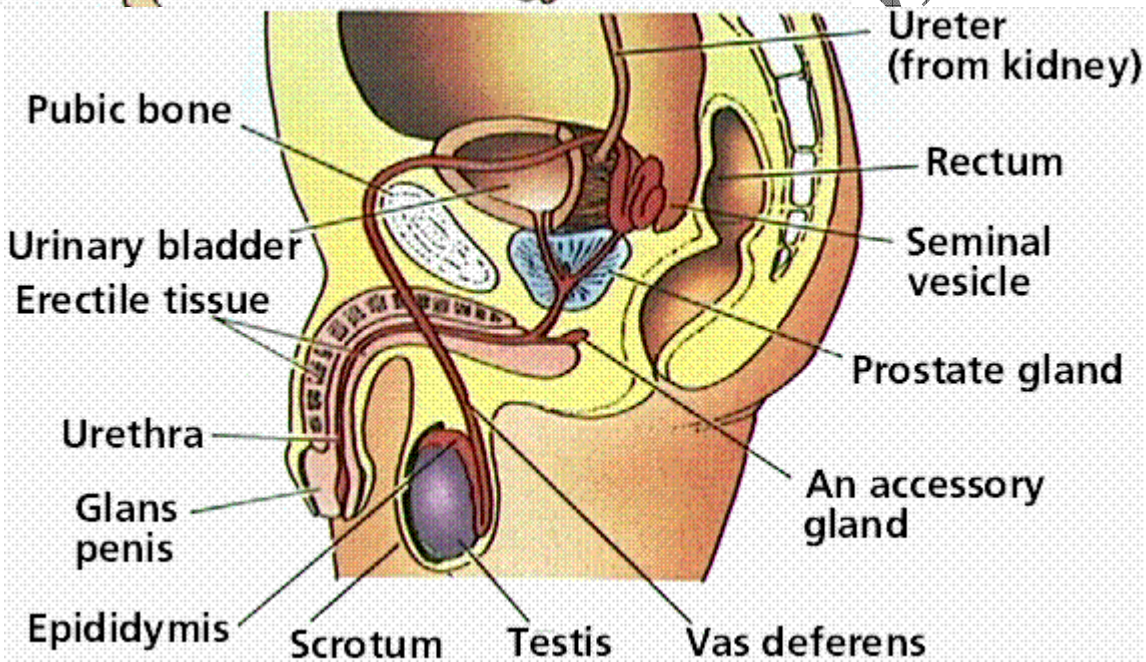
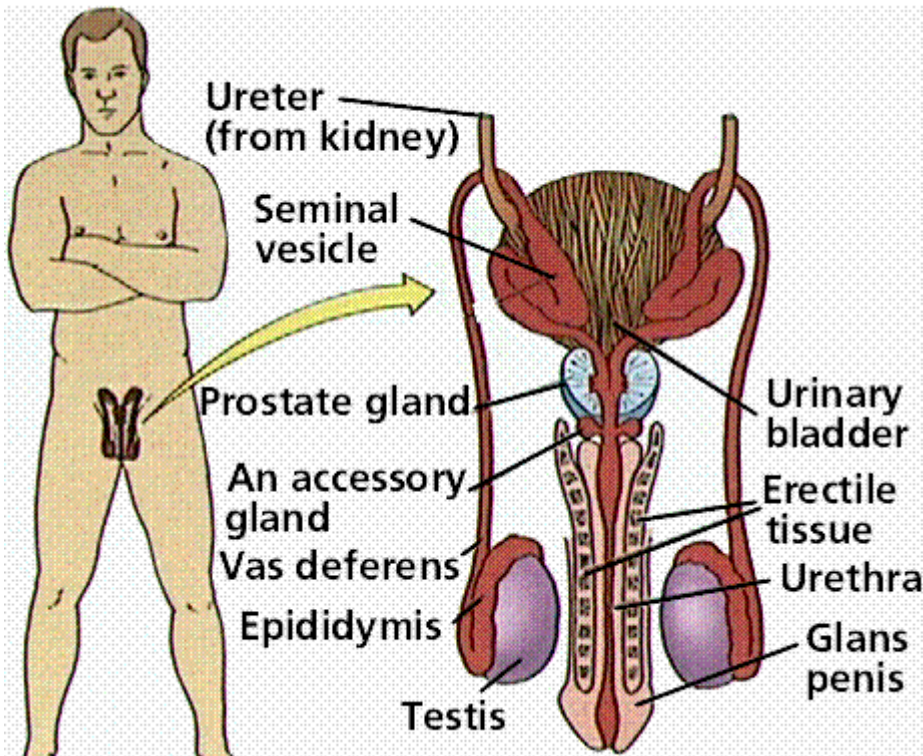
1) **Testes:** The testes are a pair of oval pinkish male sex organs suspended in abdominal cavity within a pouch called scrotum. The scrotum helps in maintaining the low temperature

of the testes ($2-2.5^{\circ}\text{C}$) necessary for spermatogenesis. The cavity of scrotal sac is connected to the abdominal cavity through the 'inguinal canal'. Testes is held in position in the scrotum of the 'gubernaculum', a fibrous cord that connects the testis with the bottom of scrotum and a 'spermatic cord' formed by the vas deferens, nerves, blood vessels and other tissues that run from abdomen down to each testicle, through inguinal canal. Each testis is enclosed in a fibrous envelope, 'tunica albuginea', which extends inwards into testis and divide it into lobules. Each lobule contains 1 to 3 highly coiled seminiferous tubules. A pouch of serous membrane 'tunica albuginea' covers the testis.

Seminiferous Tubules : Each seminiferous tubule is lined by 'germinal epithelium' which consists of undifferentiated male germ cells called 'spermatogonial mother cells' and it also bears 'nourishing cells' called 'sertoli cells'.

- Spermatogonial cells (or) primary spermatocytes undergo meiotic division, producing spermatozoa or sperms by a process spermatogenesis.
- Sertoli cells provide nutrition to spermatozoa and produce a hormone 'inhibin', which inhibits secretion of FSH.

The region outside the tubules, contain interstitial cells of 'Leydig cells'. They produce androgens, the most important in testosterone. It controls the development of secondary sexual characters and spermatogenesis. The seminiferous tubules open into vasa efferentia through the rete testis. Rete testis is a network of tubules is of the testis carrying spermatozoa from the seminiferous tubules to the vasa efferentia.



2) **Epididymis:** The vasa efferentia leave the testis and open into a narrow, tightly coiled tube called 'epididymis' located along the posterior surface of each testis. The epididymis provides a storage space for sperms and gives them time to mature. It is differentiated into three regions.

- a) Caput Epididymis
- b) Corpus Epididymis
- c) Cauda Epididymis

The caput epididymis receives spermatozoa via the vasa efferentia of the mediastinum testis. It is mass of a connective tissue at the back of the testis that encloses the rete testis.

3) Vasa Deferentia: The vas deferens or ductus deferens is a long, narrow muscular tube. The mucosa of the ducts deferens consists of a pseudo stratified columnar epithelium and lamina propria. It starts from the tail of epididymis, passes through the inguinal canal into the abdomen and loops over the urinary bladder. It receives a duct from seminal vesicle.

The vas deferens and the duct of the seminal vesicle unite to form a 'short ejaculatory duct' or 'ductus ejaculatorius'. The two ducts, carrying spermatozoa and the fluid secreted by the seminal vesicles, converge in the centre of prostate and open into urethra, which transports the sperms to outside.

4) Urethra: In male, urethra is the shared terminal duct of the reproductive and urinary systems. The urethra originates from urinary bladder and extends through the penis to its external opening called 'urethral meatus'. The urethra provides an exit for urine as well as semen during ejaculation.

5) Penis: Urethra opens into the major copulatory organ of male, the 'penis'. The penis and scrotum constitute the male external genitalia. The penis serves as a urinal duct and intromittent organ the transfers spermatozoa to the vagina of a female.

The penis is made up of three columns of tissue: two upper Corpora cavernosa on the dorsal aspect and one Corpus spongiosum on the ventral side. Skin and a subcutaneous layer enclose all three columns, which consists of special tissue that helps in erection of penis. The enlarged and bulbous end of penis is called 'glans penis', which is covered by a loose fold of skin (foreskin) called prepuce.

Male accessory glands: Male accessory glands are:

- (a) Seminal Vesicles (b) Prostate Glands (c) Bulbourethral Glands

a) Seminal Vesicles: These are a pair of simple tubular glands present posterior – inferior to the urinary bladder in the pelvis. Each seminal vesicle enters prostate gland through vas deferens. The vesicles produce seminal fluid rich in fructose, proteins, citric acid, inorganic phosphorus, potassium and prostaglandins. All these serve sperm cells.

b) Prostate Gland: It is located directly beneath the urinary bladder. The gland surrounds the 'prostatic urethra' and sends its secretions through several prostatic ducts. The prostate secretion activates spermatozoa and provides nutrition. The prostate contributes 15 – 30 % of the semen.

c) **Bulbourethral Glands:** These are also called Cowper's glands located beneath the prostate gland at the beginning of the internal portion of the penis. They add an alkaline fluid to semen and the fluid secreted by them lubricates urethra. It acts as flushing washing out the acidic urinary residues that remain in urethra, before the semen is ejaculated.

3. **Write an essay on different events that occur during development of a human?**

A. During the development of zygote into a human, a series of events takes place in mother's womb. They are:

- I. Fertilization
- II. Gastrulation
- III. Organogenesis
- IV. Placenta formation
- V. Pregnancy and Parturition

I. Fertilization: It is the formation of zygote by fusing ovum with sperms. Sperms make it way through corona radiata and zona pellucida. Acrosin released from acrosome of sperm dissolves zona pellucida of ovum and easier penetration of sperm into ovum. The entry of sperm induces the completion of meiosis of ovum. The nuclear union results in the formation of synkaryon (zygotic nucleus).

After fertilization the events that follow are:

1) **Cleavage:** After the fertilization, the first phase of embryonic development in cleavage of zygote as it moves through the isthmus of the oviduct towards the uterus. The daughter cells are called blastomeres.

2) **Morula:** Morula is a solid mass of cells and is developed in the fallopian tube and reaches the uterus for further development. The morula passes through a process called compaction, after which the embryo has a superficial flat cell layer and inner cell mass. The outer superficial layer becomes the 'trophoblast' that serves to attach the embryo to the uterine wall and the inner cell mass constitutes formative cells, which give rise to the 'embryo proper', also called the 'embryoblast'.

3) **Blastocyst:** Some fluid passes into the morula from uterine cavity thus separating the inner cell mass from trophoblast. As the quantity of fluid increases, the morula acquires a cyst shape. The cells of trophoblast become flattened and the inner cell mass attaches to the inner side of trophoblast on one side only. The morula now becomes a 'blastocyst'.

The cavity of the blastocyst is the 'blastocoel' or 'segmentation cavity' or 'primary body cavity'. The side of blastocyst to which the inner cell mass is attached is called 'embryonic'

Or 'animal pole', while the opposite side is the 'abembryonic pole'. The cells of the trophoblast above the region of inner cell mass are called 'cells of rauber'.

4) Implantation: The zona pellucida around the blastocoels disappears and cells of trophoblast stick to the uterine endometrium. The trophoblast invades endometrium and gets implanted into it, called 'interstitial implantation', which starts on the 6th day after fertilization. After the implantation, the uterine endometrium is differentiated into 'decidua'.

a) The portion of the deciduas where the placenta is to be formed is called the 'decidua basalis'.

b) The part of the deciduas that separates the embryo from the uterine lumen is called the 'decidua capsularis'.

c) The part lining the rest of the uterine cavity is called the deciduas parietalis.

At the end of pregnancy the deciduas is shed off, along with the placenta and membranes.

5) Formation of Bilaminar Embryonic disc: The inner cell mass of blastocyst forms into a disc called 'embryonic disc'. Then the 'cells of Rauber' disappears, some cells get separated by delamination and eventually forms a layer of cells that further develops into the hypoblast, which is the future extra embryonic endoderm. The remaining part of the disc is called 'epiblast'. Now the embryonic disc is called 'bilaminar embryonic disc'.

The hypoblast layer below the trophoblast encloses a cavity called 'yolk sac' or 'umbilical vesicle'. Gradually the embryonic disc becomes oval.

II. Gastrulation: Gastrulation involves proliferation, differentiation of movement of cells with in the embryo. Along the longitudinal axis of the embryonic disc, a primitive streak is formed. A longitudinal furrow, 'primitive groove' forms along the middle of primitive streak. On either side of it are the 'primitive folds'. Anteriorly primitive streak has a shallow primitive pit. The thickened part of streak is called 'primitive knot' or 'primitive node' or 'Hansen's node'.

1) Trilaminar Embryo: The future epidermal cells from epiblast, forms the endoderm of embryo. The remaining epiblast is known as 'ectoderm'. The invasion of epiblast cells into space between the epiblast and hypoblast is called gastrulation. The process of gastrulation converts the bilaminar embryonic disc to trilaminar embryonic disc.

2) Extra embryonic membranes: Now four extra embryonic or foetal membranes are formed. They are chorion, amnion, allantois and yolk sac.

(a) Between the amnion and the embryo, there is an 'amniotic cavity' filled with amniotic fluid that acts as shock absorber and also prevents embryo from shock.

(b) Allantois and chorion are fused to form 'chorioallantoic membrane' which constitute placenta.

(c) Yolk sac encloses a fluid cavity, it has no nutritive value.

III. Organogenesis: It involves series of stages.

1) Formation of notochord and neural tube: The chora mesodermal cells converge and involute through Hensen's node and extend forward as 'notochordal process'. This later transforms into a solid rod – 'notochord'. The notochord mesoderm induces the overlying endodermal cells to form neural cells which further changes into a neural tube by a process called Neurulation.

2) Differentiation of Mesoderm and formation of Coelom: The longitudinal column of mesoderm adjacent to neural tube on either side is called 'epimere' and the mesoderm around the gut is 'hypomere'. The mesoderm in between these two is 'mesomere'. The 'somites' of epimere differentiate into myotome, sclerotome and dermatome.

(a) Sclerotome – Forms the vertebral column

(b) Dermatome – Forms the dermis of the skin

(c) Myotome – Forms the voluntary muscles of the body

The hypomere splits into outer somatic and inner splanchnic mesodermal layers. Intra embryonic coelom is formed in between these two layers, which given rise to pericardial, pleural and peritoneal cavities.

IV. Placenta formation: The chorionic villi and uterine tissue interdigitate with each other to form a structural and functional unit called 'placenta' between the foetus and the mother. The maternal and foetal bloods are separated by 'placental membrane'.

Functions of Placenta:

(a) Supplies oxygen and nutrients to the embryo.

(b) Removes carbondioxide and waste materials from embryo.

(c) Progesterone secreted by it essential for maintenance of pregnancy.

(d) Oestrogen secreted by it promotes uterine growth.

(e) hCG produced is used as a test to detect pregnancy.

(f) Somatomammotropin increases glucose levels of plasma.

V. Pregnancy and Parturition:

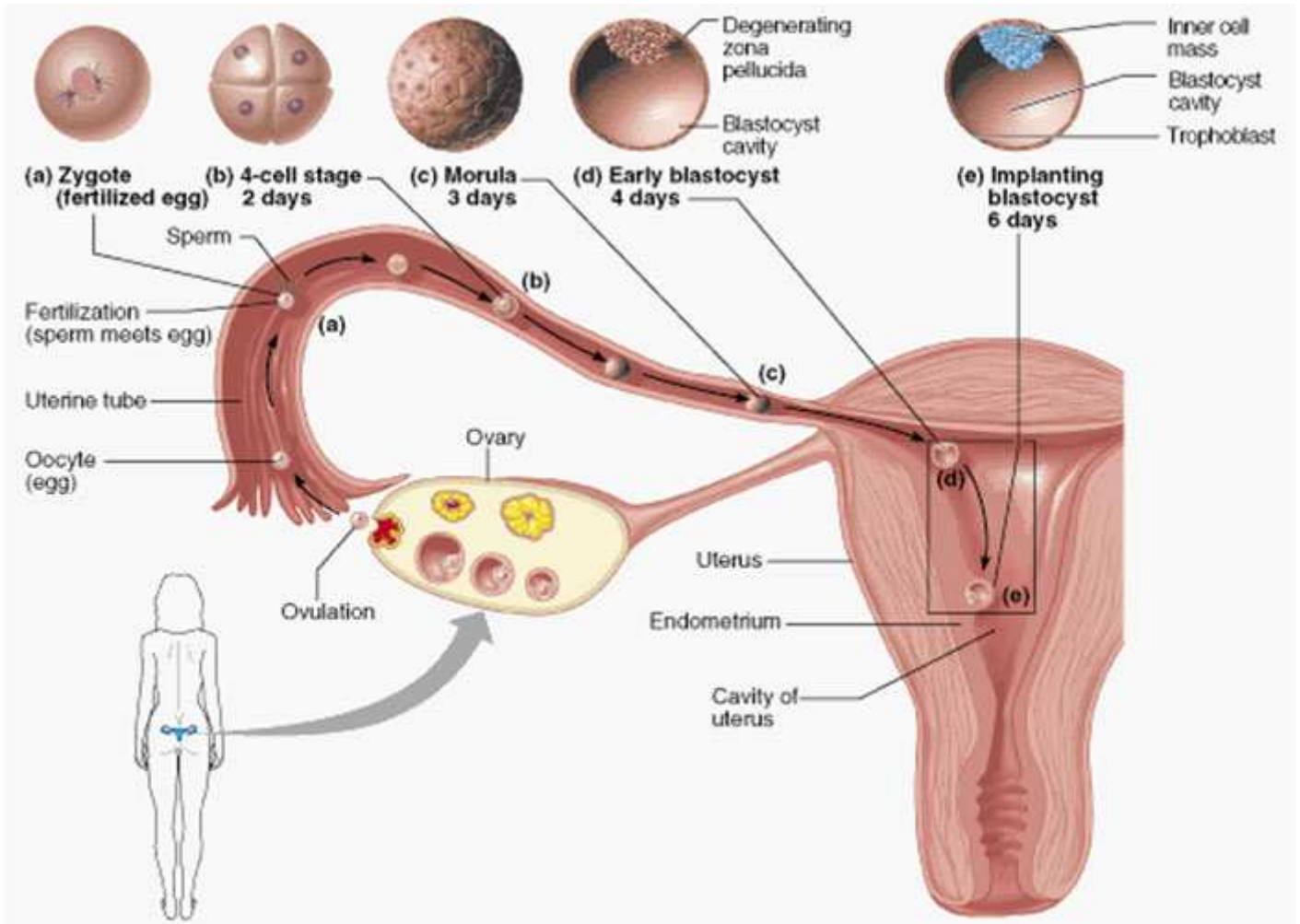
Pregnancy: It is the intra uterine development of embryo and foetus. In humans it is 266 days (38 weeks) from the fertilization of egg.

Events during pregnancy: Human gestation can be divided into 3 trimesters of three months each. The events are

- One month - Embryo's heart is formed
- Second month - Foetus develops limbs and digits
- Third month - Major organs are formed
- Fifth month - First movements and appearance of hair and head
- Six months - Body is covered with fine hair, eye lids separate and eye lashes are Formed.
- Nine months - Foetus is fully developed

Parturition: The process of delivery of foetus after labour is called parturition and is favoured by hormone oxytocin that causes stronger uterine contractions. This leads to the expulsion of baby out of the uterus through the birth canal.

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