

## CH-HUMAN REPRODUCTION

### INSTRUCTIONS-

**STEP 1-** READ THE CHAPTER- HUMAN REPRODUCTION

UNDERLINE THE DIFFICULT TERMS

PRACTICE THE DIAGRAMS

### LEARNING OBJECTIVES:

Describe male and female reproductive systems including body parts and their functions.

Describe the process of human reproduction.

Elaborate the fertilization process.

Identification of different hormones released during pregnancy.

**STEP 2-** READ THE NOTES CAREFULLY. FOLLOW THE YOUTUBE LINKS

MENTIONED AFTER EVERY TOPIC

TOPICS COVERED :

- A Male and Female reproductive system
- B Spermatogenesis and oogenesis
- C Fertilization
- D Implantation
- E Placenta
- F Parturition

**STEP 3-** ATTEMPT THE GIVEN ASSIGNMENT

**STEP 4 -** FOLLOW THE LINK TO UNDERSTAND THE CHAPTER

<https://www.youtube.com/watch?v=Lbv6WbjIOW0>-Shiksha House

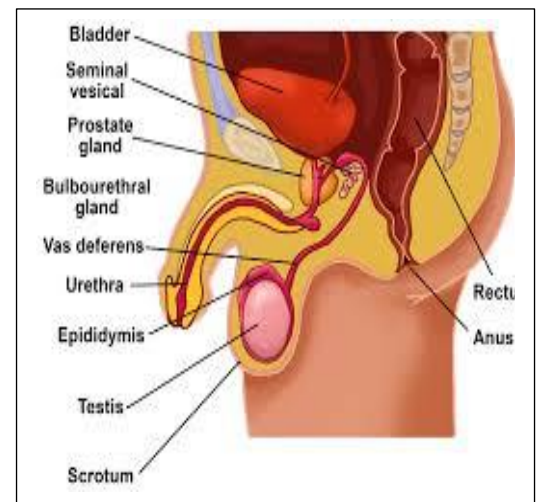
(1) **Reproduction** is the formation of new individuals of their own kind by living organisms.

(2) The **Male Reproductive System** consists of:

(a) **Primary sex organs** i.e. a pair of testes suspended in a scrotum.

**Secondary sex organs** i.e. a pair of ducts each differentiated into an epididymis, a vas deferens and an ejaculatory duct.

(c) Three types of **Glands** - a pair of seminal vesicles, a prostate gland and a pair of Cowper's glands.



[https://www.youtube.com/watch?v=T\\_WMywHIGCI](https://www.youtube.com/watch?v=T_WMywHIGCI)

### Seminal Vesicles

The paired seminal vesicles are located posterior to the urinary bladder. The fluid from the seminal vesicles is viscous and contains fructose, which provides an energy source for the sperm; prostaglandins, which contribute to the mobility and viability of the sperm; and proteins that cause slight coagulation reactions in the semen after ejaculation.

### Prostate

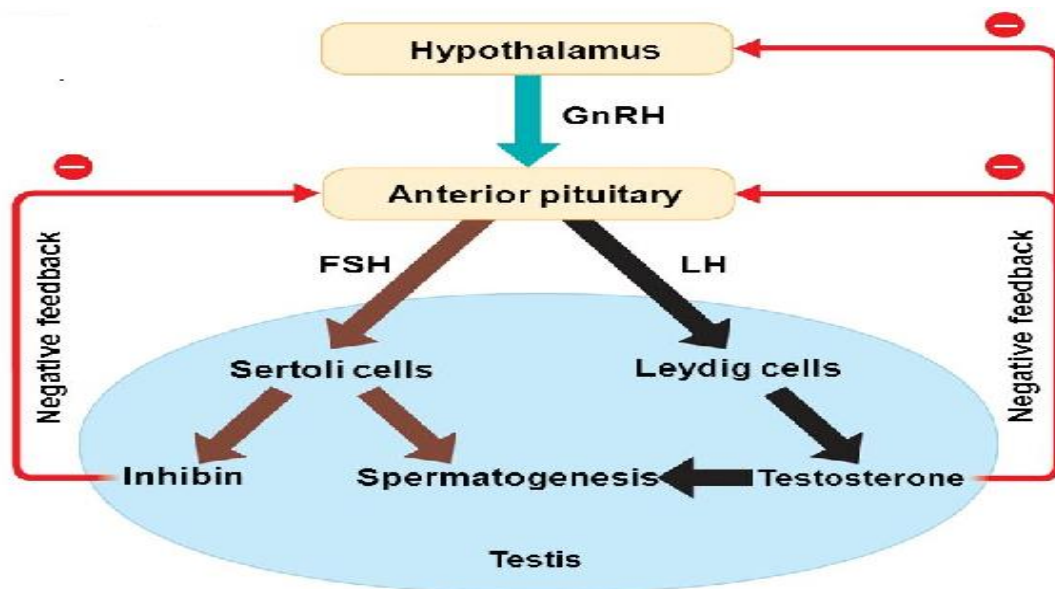
The prostate gland is a firm, dense structure that is located just inferior to the urinary bladder. It is about the size of a walnut. The secretions of the prostate are thin, milky colored, and alkaline. They function to enhance the motility of the sperm.

### Bulbourethral Glands

The paired bulbourethral (Cowper's) glands are small, about the size of a pea, and located near the base of the penis. In response to sexual stimulation, the bulbourethral glands secrete an alkaline mucus-like fluid. This fluid neutralizes the acidity of the urine residue in the urethra, helps to neutralize the acidity of the vagina, and provides some lubrication for the tip of the penis during intercourse.

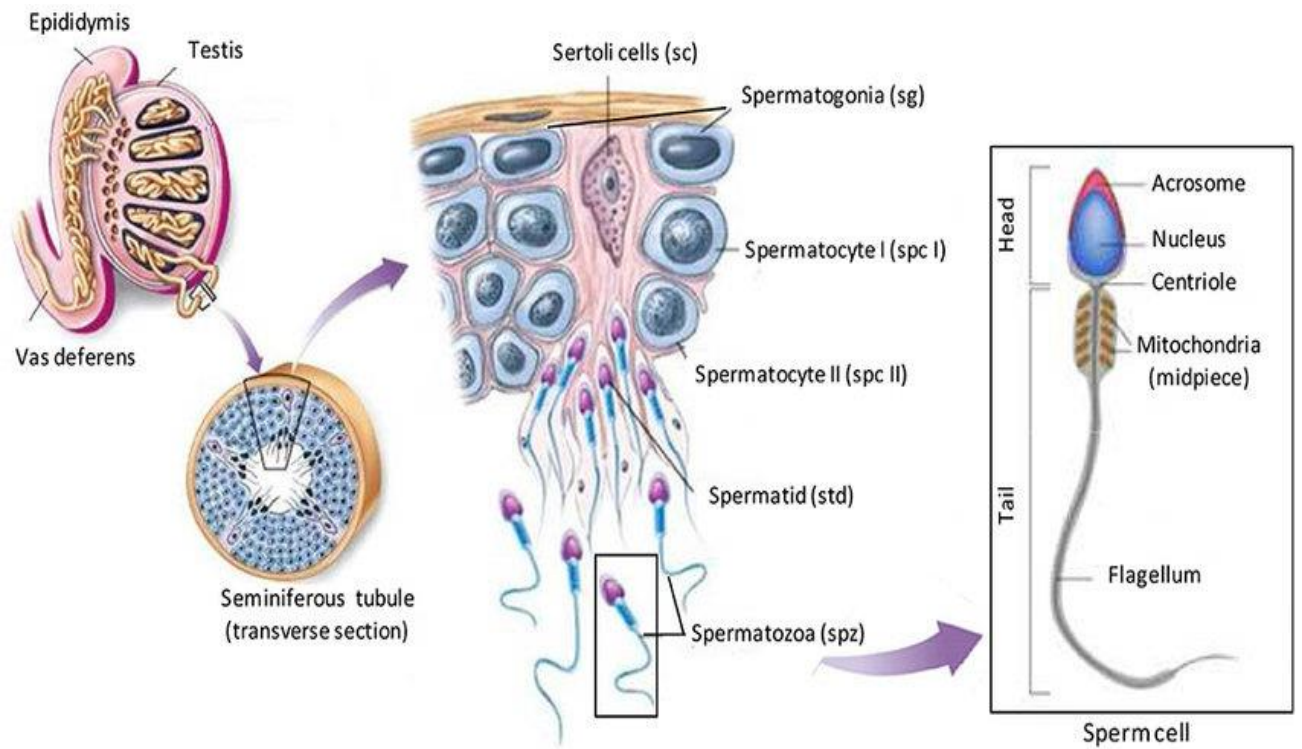
Seminal fluid, or semen, is a slightly alkaline mixture of sperm cells and secretions from the accessory glands. Secretions from the seminal vesicles make up about 60 percent of the volume of the semen, with most of the remainder coming from the prostate gland. The sperm and secretions from the bulbourethral gland contribute only a small volume.

### SPERMATOGENESIS- HORMONAL CONTROL

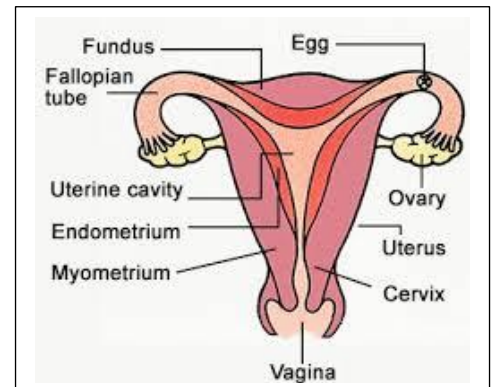


### SPERMATOGENESIS- SPERM PRODUCTION

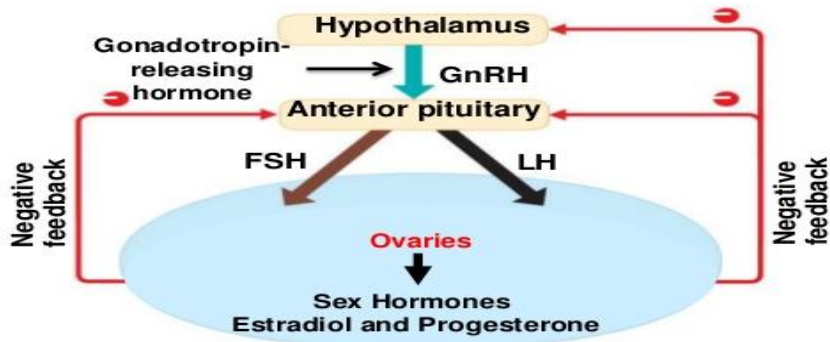




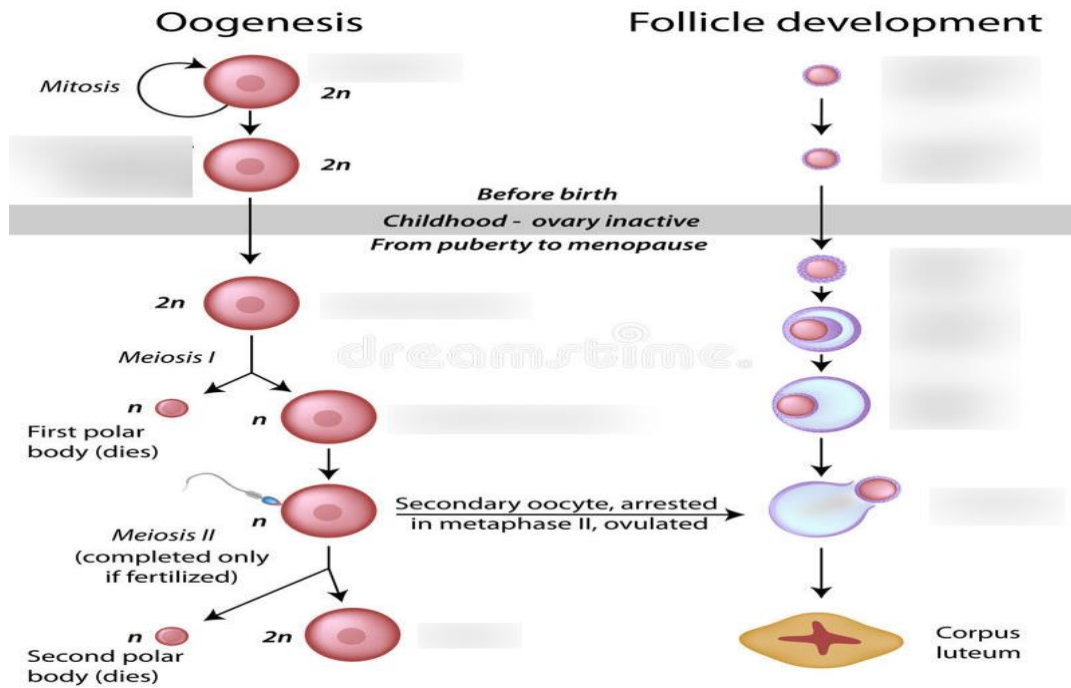
- (3) The **Female Reproductive system** consists of:
- (a) **Primary sex organ** i.e. a pair of ovaries
  - (b) **Secondary sex organs** i.e. a pair of fallopian tubes (oviducts) , a uterus (womb), a vagina.
- (4) Ovaries produce female gametes called ova.



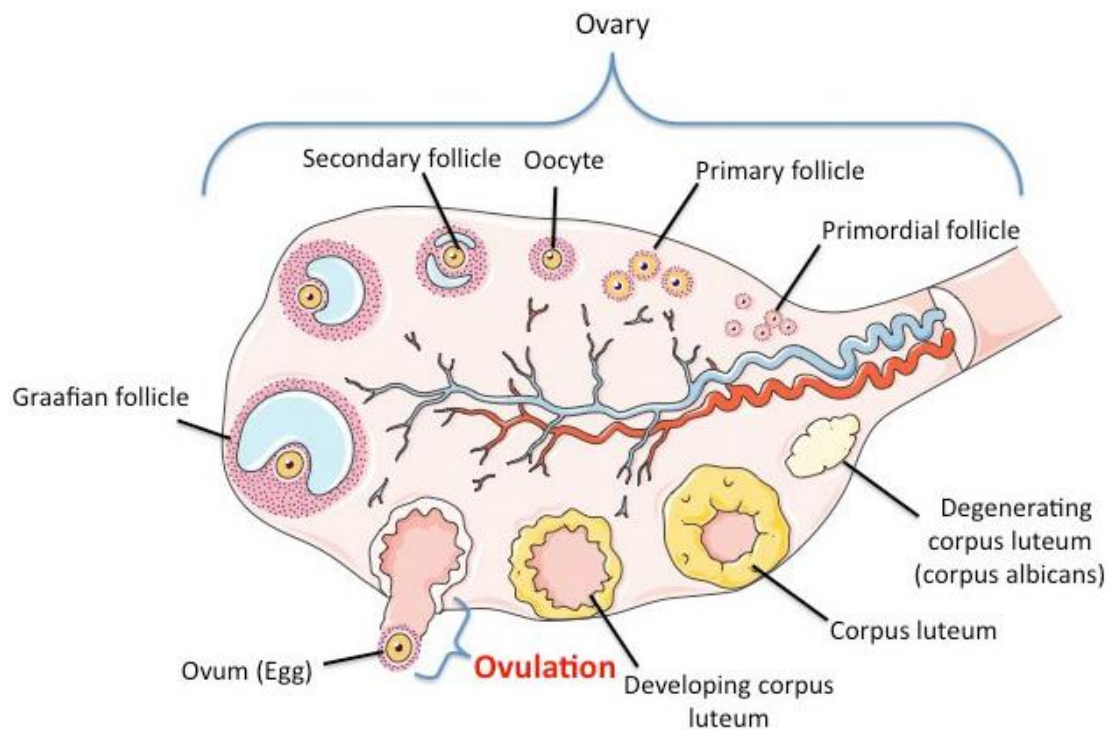
## OOGENESIS- HORMONAL CONTROL



**OOGENESIS- OVUM PRODUCTION-**



[https://www.youtube.com/watch?v=Y\\_-MnlOfbY](https://www.youtube.com/watch?v=Y_-MnlOfbY)



**Fertilization-** <https://www.youtube.com/watch?v=7G2rL5Cutd4>

(1) **Definition:** Fusion of a haploid male gamete (spermatozoon) and a haploid female gamete (ovum) to form a diploid cell, the zygote, is called fertilization or syngamy.

(2) **Site of fertilization:** Fertilization in human female is internal as in other mammals. It takes place usually in the ampulla of the fallopian tube.

(3) **Steps of fertilization**

(i) **Approach of sperm to ovum:**

(a) Male discharges semen (3.5 ml) in the female's vagina close to the cervix during coitus. This is called ejaculation or insemination. This ejaculation contains as many as 400 million sperms but only about 100 sperms reach the fallopian tube because many sperms are either killed by the acidity of female genital tract or engulfed by the phagocytes of the vaginal epithelium.

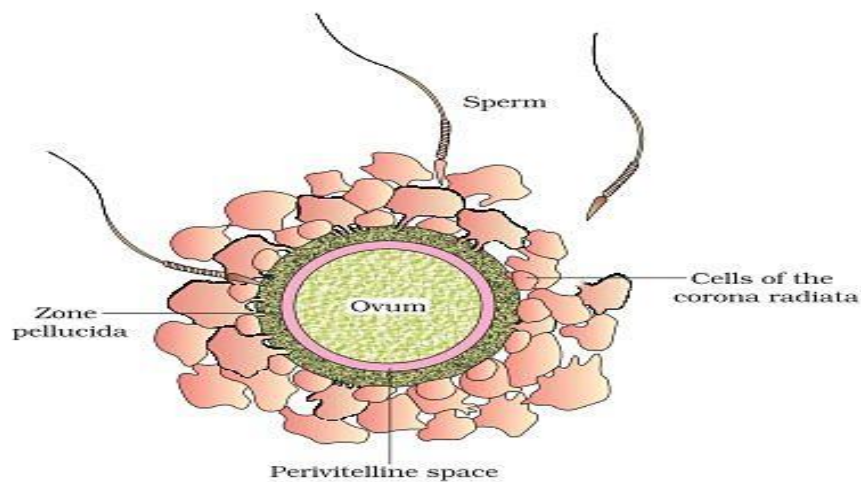
(b) The sperm swim in the seminal fluid at the rate of 1-4 mm per minute

(c) **Capacitation** is the phenomenon of physiological maturation of sperms by breaking of acrosome membrane inside the female genital tract. It takes about 5-6 hours.

(d) **Ovum is released on the 14<sup>th</sup> day of menstrual cycle**

(e) At the time of ovulation, **egg is at secondary oocyte stage.**

(f) Fertilizability of human sperm in the female genital tract is of 12 to 24 hours while its survival value is upto 3 days and of ovum is only 24 hours though it can live for about 72 hours.



(ii) **Penetration of sperm:**

(a) The ovum secretes a chemical substance called fertilizin, which has a number of spermophilic sites on its surface where the sperm of species specific type can be bound by their antifertilizin site.

(b) This **fertilizin-antifertilizin interaction** causes agglutination (sticking together) of egg and sperm.

(c) **Ovulation in the human female occurs at secondary oocyte stage in which meiosis-I have been completed and first polar body has been released but second maturation is yet to complete.**

(d) Penetration of sperm is a chemical mechanism.

(e) In this acrosome of sperm undergoes acrosomal reaction and releases certain sperm lysins which dissolve the egg envelopes locally and make the path for the penetration of sperm.

(f) These sperm lysins contain a lysing enzyme hyaluronidase which dissolves the hyaluronic acid polymers in the intercellular spaces which holds the granulosa cells of corona radiata together; corona penetrating enzyme (that dissolves the corona radiata) and acrosin (which dissolves the zona pellucida). Then it dissolves the zona pellucida.

(g) Only sperm nucleus and middle piece enter the ovum. The tail is lost.

(iii) **Cortical reaction:**

(a) Immediately after the entry of a sperm into the egg, the later shows a cortical reaction to check the entry of more sperms.

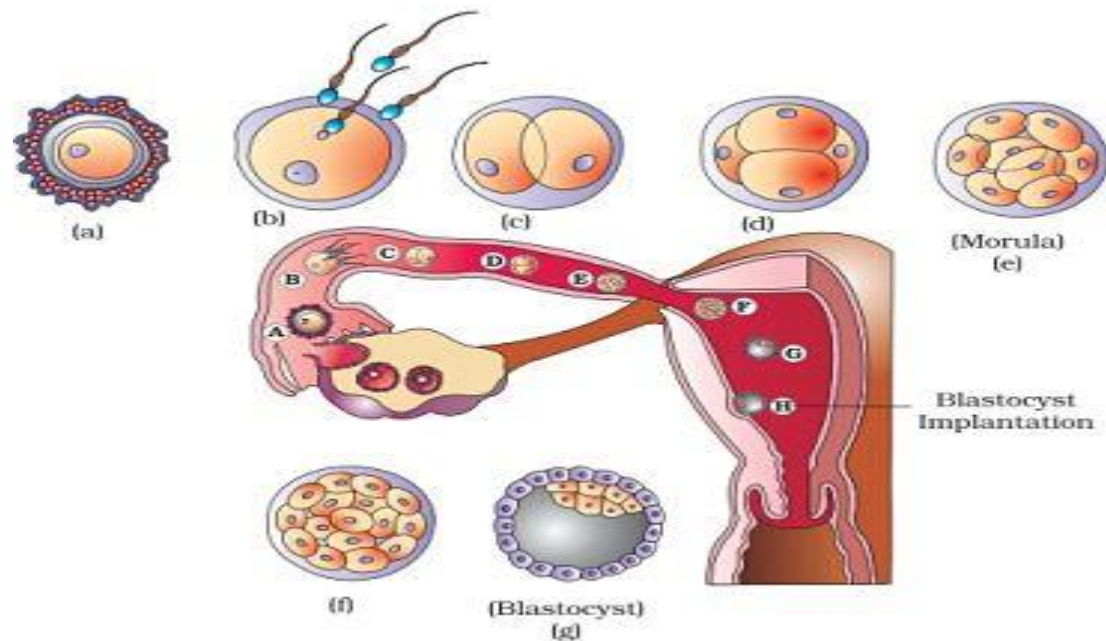


(b) In this reaction, the cortical granules present beneath the egg's plasma membrane release chemical substance between the ooplasm and the plasma membrane (vitelline membrane).

(c) These substances raise the vitelline membrane above the egg surface. The elevated vitelline membrane is called fertilization membrane.

(d) The increased space between the ooplasm and the fertilization membrane and the chemical present in it effectively check the entry of other sperm.

(e) If polyspermy occurs, that is more than one sperm enter the secondary oocyte, the resulting cell has too much genetic material to develop normally.



#### (iv) Fusion of gametic nuclei:

(a) Entrance of spermatozoon serves to act as stimulus which causes the second maturation division.

(b) The centriole brought in by the spermatozoon subdivides into two

(c) With the production of the second polar body, the egg nucleus or female pronucleus is ready for union with the male pronucleus provided by the sperm head.

(d) The male pronucleus which has been advancing the penetration path, now moves directly toward the female pronucleus.

(e) The centrioles of middle piece of sperm form a spindle.

(f) The nuclear membrane of the gametic nuclei degenerates and two sets of chromosomes initially lie on two poles of the spindle but later these sets of chromosomes mix up and the process is called **amphimixis**.

(g) The fertilized egg is now called zygote and the zygote nucleus is called **synkaryon**.



### **Significance of fertilization**

- (a) It provides stimulus for the egg to complete its maturation.
- (b) It activates the ovum to develop into a new individual by repeated mitotic division.
- (c) Fertilization restores the diploid number of chromosomes (46 in man) in the zygote by adding male's haploid set of chromosomes.
- (d) It makes the egg more active metabolically.
- (e) It combines the character of two parents and introduces variations. So help in evolution.
- (f) Sex chromosomes of sperm is either X or Y and helps in sex determination.
- (g) Fertilization membrane formed after sperm entry, checks the entry of additional sperms.

### **Menstrual Cycle**

<https://www.youtube.com/watch?v=dq3MdeSDDC4>

- (1) Menstruation occurs in human, apes and old world monkeys(primates).
- (2) Menstruation is bleeding from the uterus of adult females at intervals of one lunar month.
- (3) Beginning of menstruation or first menstruation is called **menarche**.
- (4) The beginning of menstruation varies. It usually occurs between 12 and 15 years.
- (5) The cycle of events starting from one menstruation till the next one is called **Menstrual Cycle**.
- (6) In human females, menstruation is repeated at an average interval of about 28/29 days.
- (7) One ovum is released (ovulation) during the middle of each menstrual cycle.
- (8) It is regulated by certain hormones, some of which are secreted by the pituitary gland.
- (9) The pituitary gland is stimulated by releasing factors produced in the hypothalamus.
- (10) The hormones produced by the pituitary gland influence the ovaries. The hormones secreted by the ovaries affect the walls of the uterus.

## Phases of Menstrual Cycle

The menstrual cycle consists of following four phases:

### (1) Menstrual Phase:

(i) In a 28 days menstrual cycle, the menses takes place on cycle days 3-5.

(ii) The production of LH from the anterior lobe of the pituitary gland is reduced.

(iii) The withdrawal of this hormone causes degeneration of the corpus luteum and, therefore progesterone production is reduced.

(iv) Production of oestrogen is also reduced in this phase.

(v) The endometrium of uterus breaks down & menstruation begins.

(vi) The cells of endometrium secretions, blood & unfertilised ovum constitutes the menstrual flow.



### (2) Follicular Phase:

(i) This phase usually includes cycle days 6-13 or 14 in a 28 days cycle.

(ii) The follicle stimulating hormone (FSH) secreted by the anterior lobe of the pituitary gland stimulates the ovarian follicle to secrete oestrogens.

(iii) Oestrogen stimulates the proliferation of the endometrium of the uterine wall.

(iv) The endometrium becomes thicker by rapid cell multiplication and this is accompanied by an increase in uterine glands & blood vessels.



### (3) Ovulatory Phase:

(i) Both LH & FSH attain a peak level in the middle of cycle (about 14th day).

(ii) Oestrogen concentration in blood increases.

(iii) Rapid secretion of LH induces rupturing of graafian follicle and thereby the release of ovum.

(iv) In fact LH causes ovulation.



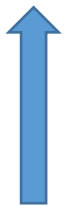
### (4) Luteal Phase:

(i) Includes cycle days 15 to 28.

(ii) Corpus luteum secretes progesterone.

(iii) Endometrium thickens.

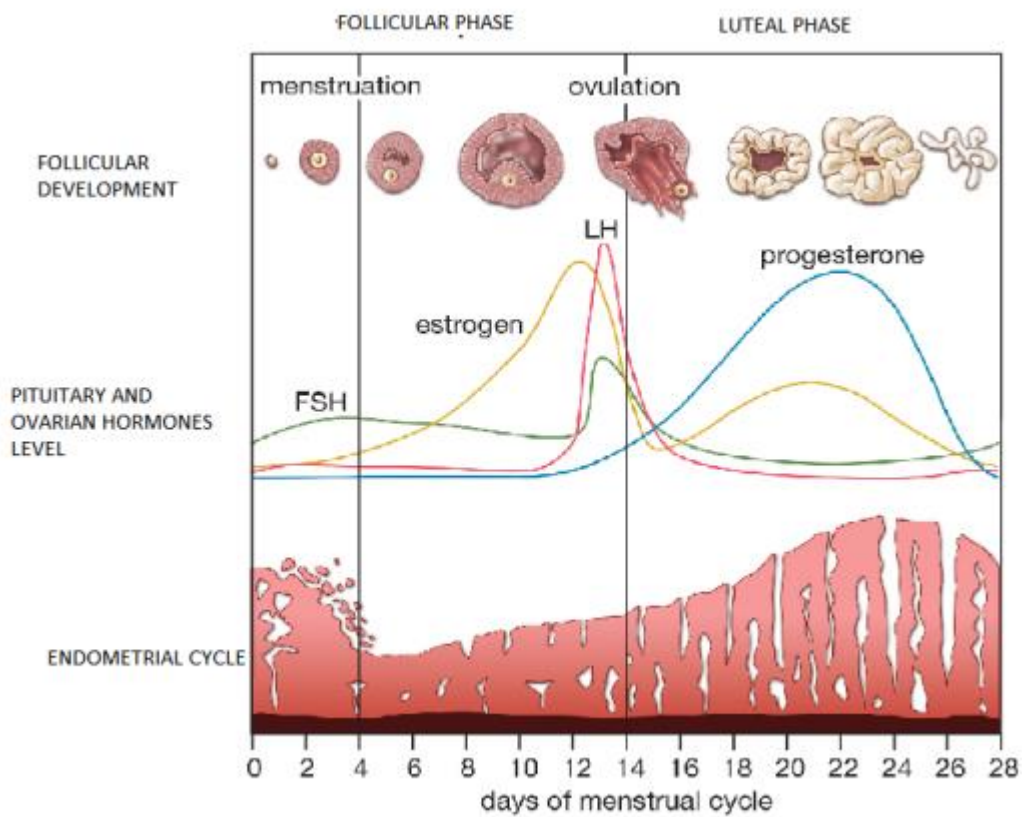
(iv) Uterine glands become secretory.



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## Hormonal Control of MENSTRUAL CYCLE

- (i) FSH stimulates the ovarian follicles to produce oestrogens.
- (ii) LH stimulates corpus luteum to secrete progesterone.
- (iii) Menstrual phase is caused by the increased production of oestrogens.
- (iv) LH causes ovulation
- (v) Proliferative phase is caused by the increased production of oestrogens.
- (vi) Secretory phase is caused by increased production of progesterone.



## Phases of embryonic development

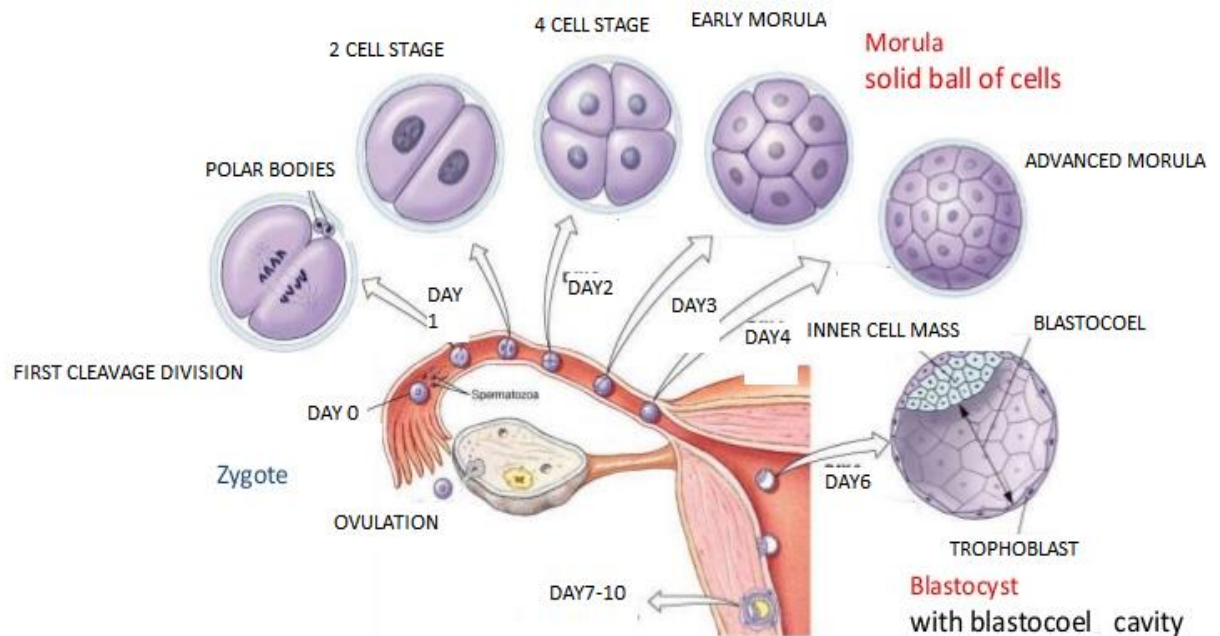
Embryonic development involves following dynamic changes and identifiable process.

(1) **Gametogenesis** : It involve the formation of haploid sex cells or gametes called sperms and ova from diploid primary germ cells called gametogonia present in the reproductive organs called gonads (testes and ovary). It is of two types;

- (i) **Spermatogenesis**: Formation of sperm.
- (ii) **Oogenesis** : Formation of ova

(2) **Fertilization:** It involves the fusion of haploid male and female gametes to form diploid zygote. The fusion of gametic pronuclei is called Karyogamy while the mixing of two sets of chromosomes of two gametes is called amphimixis.

(3) **Cleavage:** It includes the rapid mitotic division of the zygote to form a single layered hollow spherical larva called blastula and its formation is called blastulation.



#### (4) Implantation:

<https://www.youtube.com/watch?v=btp4jCZ5K4>

The process of attachment of the blastocyst (mammalian blastula) on the endometrium of the uterus is called implantation.

(5) **Gastrulation:** It includes the mass and orderly migration of the organ specific areas from the surface of blastula to their predetermined position which finally produces a 3 layered gastrula larva. It is with 3 primary layers.

(6) **Organogenesis:** It includes the formation of specific organs system from three primary germ layers of gastrula and also includes the morphogenesis and differentiation.

Pregnancy occurs when the sperm fertilizes the egg, and the zygote is formed. The zygote gets implanted in the wall of the uterus. As soon as the implantation takes place, the need for nourishment and care arises as the growth of the zygote develops into an embryo which further grows into a baby. This responsibility is taken up by a layer formed between the baby and the mother, called the placenta. The placenta is formed by finger-like projections called chorionic villi and the uterine tissue. This layer plays many roles during pregnancy, which are briefly discussed as follows:-

Providing nutrients and oxygen to the growing fetus.

It also removes the waste materials given out by the fetus substituting the function of the digestive system and the excretory system.

The placenta releases hormones like human placental lactogen, progesterone, estrogen, human chorionic gonadotropin and relaxin which are necessary for the growth of the fetus.

The umbilical cord that connects the fetus to the placenta helps in transportation of substances required for growth from the mother to the fetus.

### **Parturition**

It is the process of the contraction of the uterus at regular intervals that helps in the delivery of the baby at the end of pregnancy. The signals that the fully developed fetus sends through the placenta for ejection is called Fetal ejection reflex. These signals induce muscular contractions.

The time period from fertilization to childbirth is called the gestation period.

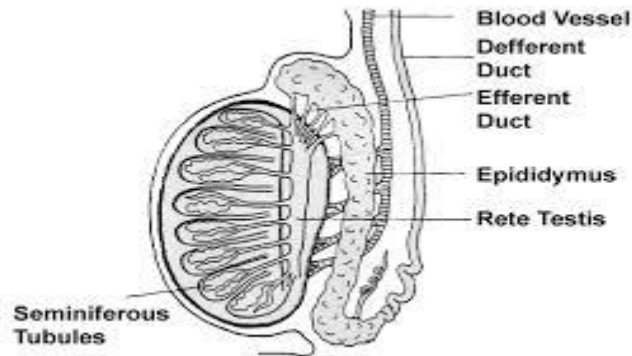
### **Lactation**

It is the process of production of milk by the mammary glands at the end of pregnancy. The milk produced initially by the glands is called colostrum. This milk is crucial for the baby as it provides the child with the initial immunity.

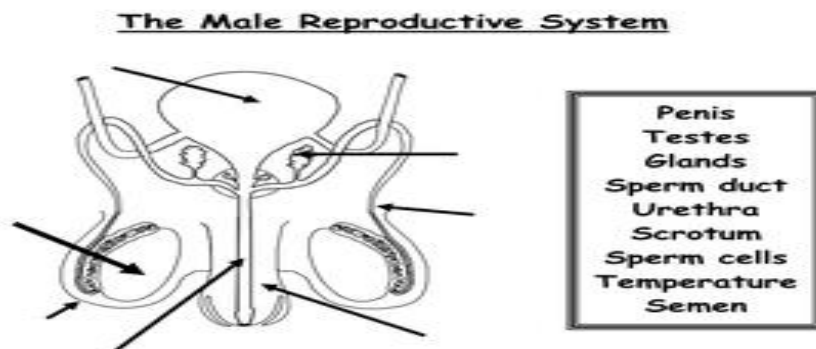
## ASSIGNMENT

1. What is the role of the following parts in the diagram given below:

**Rete testis, Epididymis and Seminiferous tubules**



2. Identify the labels in the picture given below:

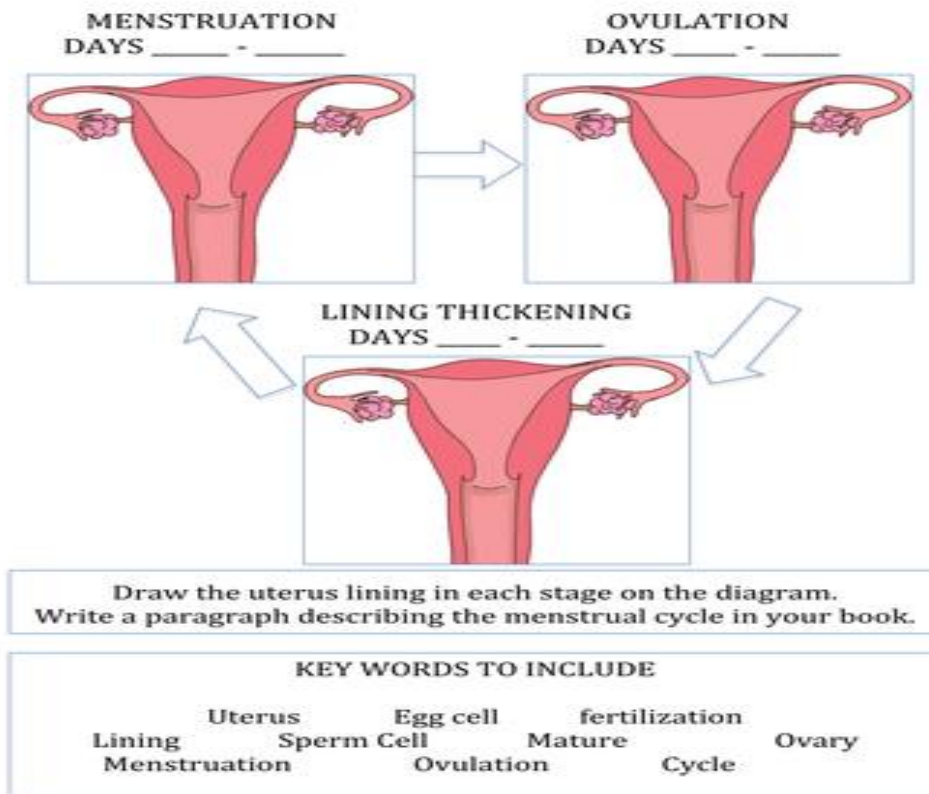


The male sex cells are the \_\_\_\_\_.  
 Sperm cells are made in the \_\_\_\_\_.  
 The testes are held outside the body in a bag of skin called the \_\_\_\_\_. This keeps the sperm at the right \_\_\_\_\_.  
 Sperm travel up the \_\_\_\_\_ where liquids are added from the \_\_\_\_\_.  
 This mixture is called \_\_\_\_\_.  
 Semen flows out of the \_\_\_\_\_ through a tube called the \_\_\_\_\_.

3.

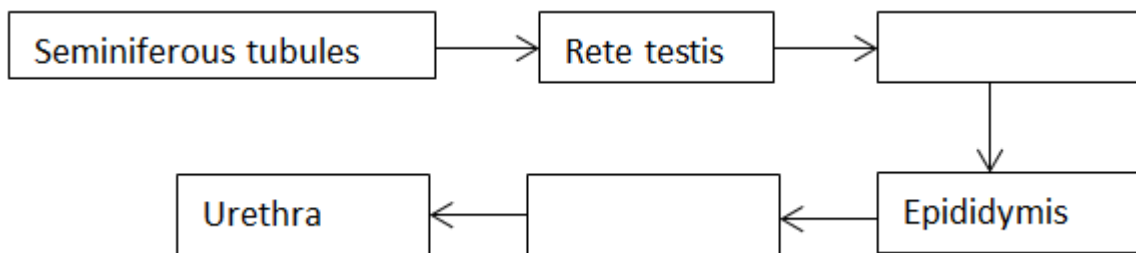


**The Menstrual Cycle**



3. List the following events observed in human reproduction in chronological order. Fertilization, gametogenesis, insemination, gestation, parturition, implantation

4. Fill in the missing boxes exhibiting the route of sperm transport.



5. State the significance of cervix in the female reproductive system.

6. What is the reason for the absence of menstrual cycles during conception or pregnancy?

7. Fill up the missing data in the table where Column A shows female reproductive organs and Column B shows its respective functions.

Column A (Organs)	Column B (Corresponding Functions)
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Ovaries	Ovulation
Oviduct	
	Pregnancy
Vagina	Birth

8. Name the hormone crucial in parturition. Does the parturition signal originate from the

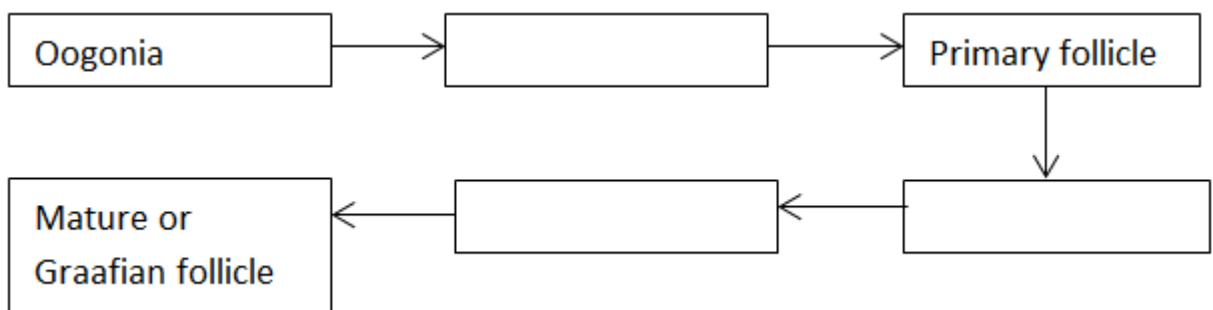
mother or the fetus?

9. State the role of the epididymis in male fertility.

10. List the names of the hormones, endocrine glands along with functions of the hormones that are crucial in causing spermatogenesis.

11. Fill in the missing boxes for the levels in the transformation of mother germ cells

into a mature follicle.



12. What are the events that cause the chromosome number of gametes to go from  $2n$ ,

$n$ , and again back to  $2n$  during reproduction?

13. How is a primary oocyte different from a secondary oocyte?