
3. Human Reproduction

Question 1. Fill in the blanks:

- (a) Humans reproduce _____ (asexually/sexually)
- (b) Humans are _____ (oviparous, viviparous, ovoviviparous)
- (c) Fertilisation is _____ in humans (external/internal)
- (d) Male and female gametes are _____ (diploid/haploid)
- (e) Zygote is _____ (diploid/haploid)
- (f) The process of release of ovum from a mature follicle is called _____
- (g) Ovulation is induced by a hormone called _____
- (h) The fusion of male and female gametes is called _____
- (i) Fertilisation takes place in _____
- (j) Zygote divides to form _____ which is implanted in uterus.
- (k) The structure which provides vascular connection between foetus and uterus is called _____

Answer: a) Humans reproduce sexually.

(b) Humans are viviparous.

(c) Fertilisation is internal in humans.

(d) Male and female gametes are haploid.

(e) Zygote is diploid.

(f) The process of release of ovum from a mature follicle is called ovulation.

(g) Ovulation is induced by a hormone called Leutinizing hormone.

(h) The fusion of male and female gametes is called fertilization.

(i) Fertilisation takes place in oviduct.

(j) Zygote divides to form blastula which is implanted in uterus.

(k) The structure which provides vascular connection between fetus and uterus is called umbilical cord.

Question 2. Draw a labelled diagram of male reproductive system.

Answer: The primary male reproductive organ is a pair of testes. The testes lies in small sac like muscular structure outside the abdominal cavity called scrotum. Scrotum provides an optimal temperature for formation of sperm. This temperature is 1-3oC lower than the temperature of the body. The function of testes is to produce sperms and the male hormone (testosterone). Testes form sperms throughout the reproductive life (puberty stage onwards) of man. From each of the testis arises a long tube called vas deferens. It unites with a duct coming from the urinary bladder to form a common tube called urethra. The urethra is enclosed within a thick muscular organ, called penis, and opens to the outside through a male genital pore. There is only one opening for the urine and sperms.

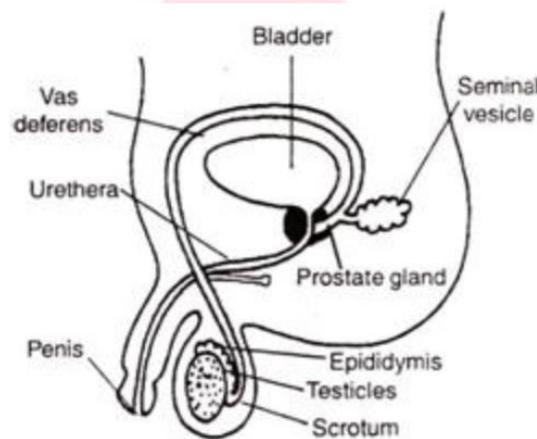
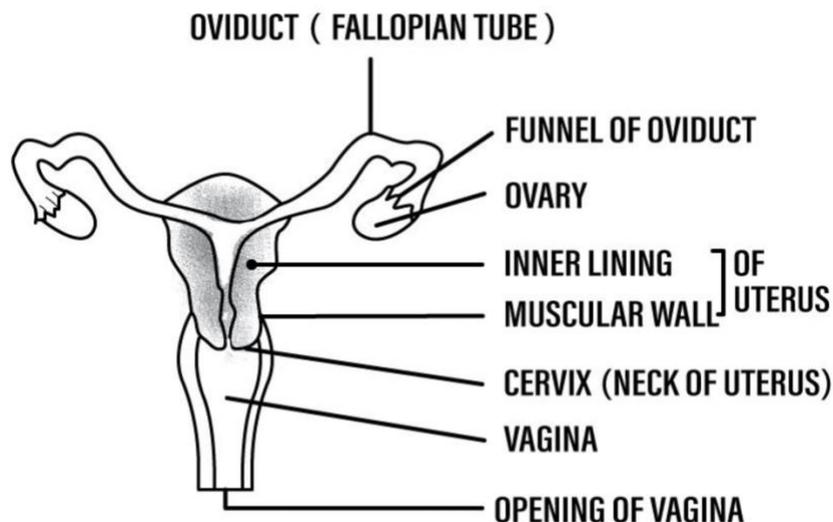


Fig. Male reproductive system.

Question 3. Draw a labelled diagram of female reproductive system.

Answer: On each side of the uterus lie two whitish oval bodies called ovaries. Ovaries produce eggs. Only one egg is produced by an ovary alternatively every month. A pair of narrow, muscular, long ducts extend from each ovary to the upper part of the uterus. These are called the oviducts or fallopian tubes. The mouth of these oviducts is expanded to form a funnel shaped structure. The uterus is a hollow, inverted pear shaped muscular organ found in the pelvic cavity between the urinary bladder and the rectum. The embryo grows and develops in the uterus. The uterus opens to the outside through a long, muscular tube called vagina, situated between the rectum and the urethra.



Question 4. Write two major functions each of testis and ovary.

Answer:

(i) Functions of testis:

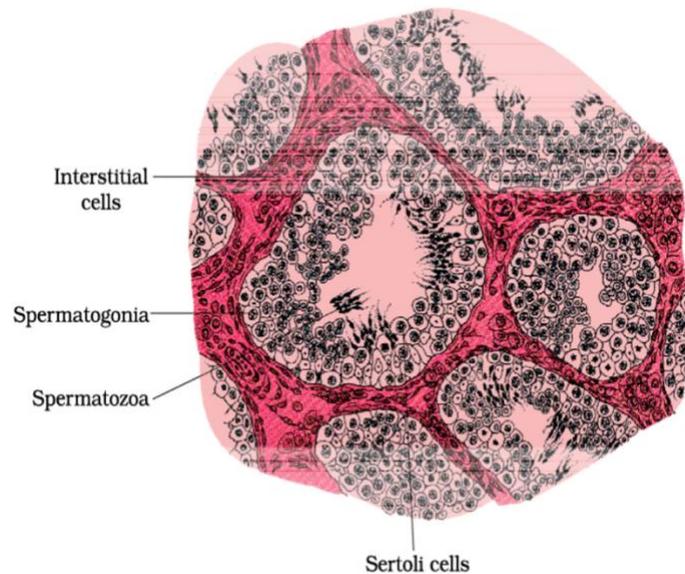
- (a) Formation of sperms by the process of spermatogenesis.
- (b) Secretion of testosterone hormone.

(ii) Functions of ovary:

- (a) Formation of ova by the process of oogenesis.
- (b) Secretion of female hormones like estrogens, progesterone and relaxin.

Question 5. Describe the structure of a seminiferous tubule.

Answer: Seminiferous tubules are highly coiled structures present in testicular lobules. The seminiferous tubules are lined by two types of cells i.e. spermatogonia and sertoli cells from inside. Spermatogonia are the male germ cells that form sperms through meiotic divisions followed by mitotic division, while Sertoli cells provide nutrition to the germ cells. The regions outside the seminiferous tubules called is called the interstitial space and it contains small blood vessels and Leydig cells. The Leydig's cells secrete androgens.



Question 6. What is spermatogenesis? Briefly describe the process of spermatogenesis.

Answer: Spermatogenesis

The process of formation of sperms is called spermatogenesis. It involves 3 phases- multiplication phase, growth phase, maturation phase.

In multiplication phase, male germ cells also called as spermatogonia undergo mitotic divisions to form large number of spermatogonia.

In growth phase, spermatogonia increases their size by accumulation of nutrition in the cytoplasm and are ready for meiotic division and the spermatocytes are called as primary spermatocytes with 46 chromosomes.

In maturation phase- A primary spermatocyte completes the first meiotic division leading formation of two equal, haploid cells called secondary spermatocytes, which have only 23 chromosomes each and the secondary spermatocytes undergo the second meiotic division to produce four equal, haploid spermatids

Spermiogenesis-

The spermatids are transformed into sperms, also called as spermatozoa by the process called spermiogenesis.

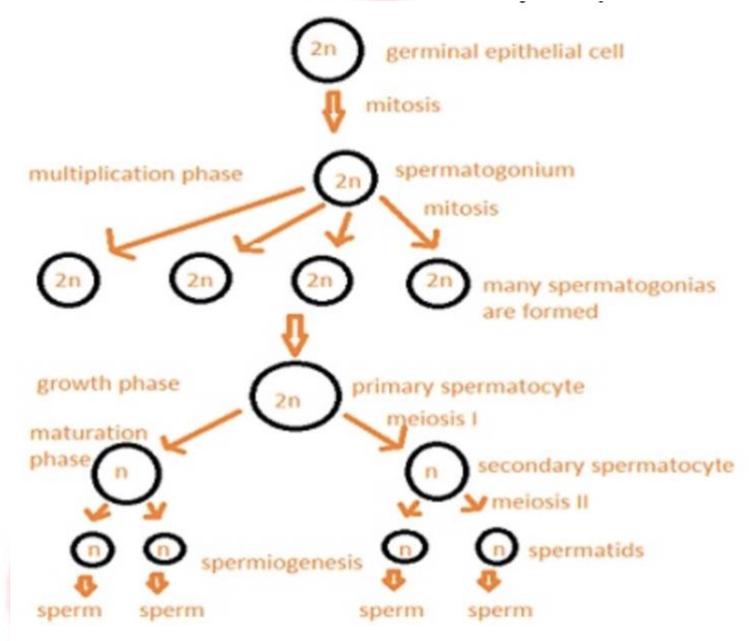
After spermiogenesis, sperm heads become embedded in the Sertoli cells and are released from the seminiferous tubules by the process called spermiation.

Hormonal control of spermatogenesis

Spermatogenesis starts at the age of puberty due to significant increase in the secretion of gonadotropin releasing hormone (GnRH) from hypothalamus.

The increases level of gonadotropin releasing hormone stimulates the anterior pituitary to

secrete luteinizing hormone(LH) and follicle stimulating hormone(FSH).
 LH acts at the Leydig cells and stimulates synthesis and secretion of androgens.
 Androgens stimulate the process of spermatogenesis.
 FSH acts on the Sertoli cells and secrete two factors- androgen binding protein (ABP) and inhibin which helps in spermiogenesis.



Question 7. Name the hormones involved in regulation of spermatogenesis.

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Question 8. Define spermiogenesis and spermiation.

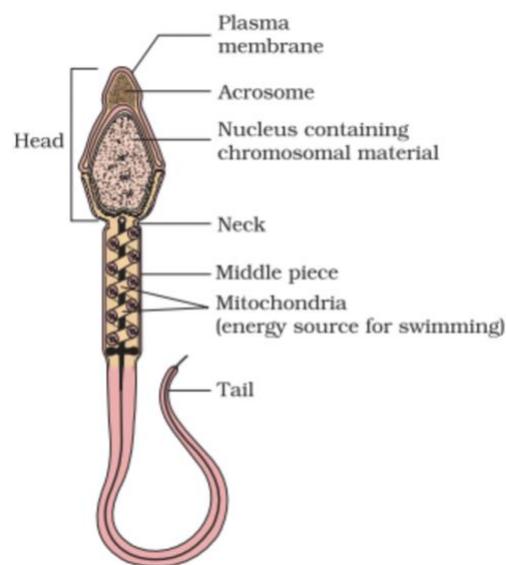
Answer: Spermiogenesis - is a process in which spermatids are transformed into mature sperms/spermatozoa.

Spermiation – is a process in which the mature spermatozoa are released into the lumen of seminiferous tubules from the sertoli cells.

Question 9. Draw a labelled diagram of sperm.

Answer: Spermatozoon is a mature male gamete or reproductive cell. A sperm cell comprises of a round or cylindrical nucleated cell. a short neck, and a thin motile tail. The structure of sperm is very important for its motility and function in sexual reproduction. The nucleus contains half of the genetic information and fuses with the ovum (female gamete) to form a zygote. A sperm cell determines the sex of its offspring in mammals, if it bears Y chromosome, then male offspring will be the result and if X chromosome the female offspring.

Diagrammatic representation of a sperm:



Question 10. What are the major components of seminal plasma?

Answer:

1. The secretions of seminal vesicles, prostate gland, and Cowper's glands.
2. Spermatozoa
3. About 70% of the seminal plasma is secreted by seminal vesicles. It is rich in fructose, citrate, prostaglandins and certain enzymes.

Question 11. What are the major functions of male accessory ducts and glands?

Answer:

The male accessory ducts are:

Rete testis- The seminiferous tubules are closed at one end and on the other end it is joined to a network of rete testis from where fine ciliated ductules, the vasa efferentia arise.

Vasa efferentia: They are the fine ciliated ductules, which transport the sperm to the epididymis.

Epididymis- It stores the sperm and secretes the fluid which is considered to nourish the sperms.

Vasa deferentia- A vasa deferens emerges from the cauda epididymis on each side of the scrotal sac and enters the abdominal cavity.

The accessory ducts are responsible for the storage and transportation of sperms from the testis to the outside through the urethra.

The male accessory glands are:

Seminal vesicles- The seminal vesicles are one pair of sac-like structure which joins vasa deferentia to form ejaculatory ducts. The secretions of the seminal vesicles contain fructose and hormones like prostaglandins. Fructose provides energy to the sperms. The prostaglandins stimulate the secretion of uterine contractions and help the movement of the sperms inside the female uterus.

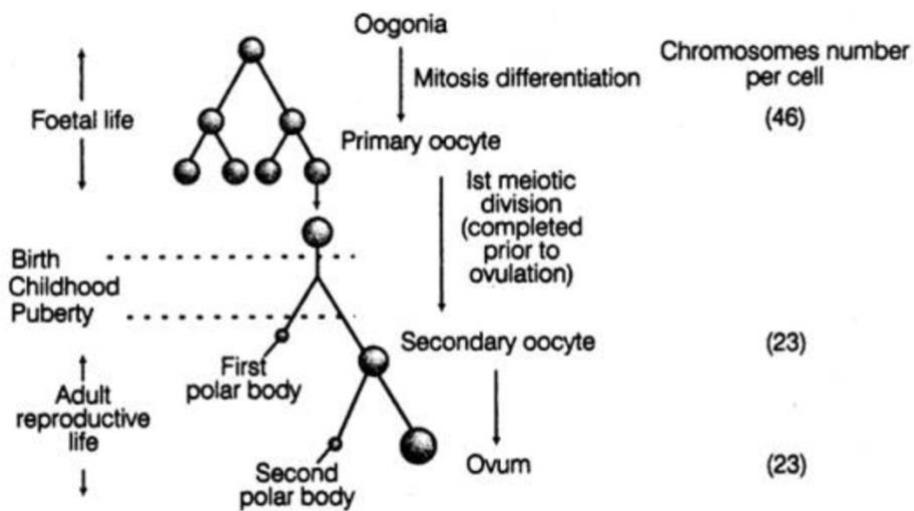
Prostate gland: The secretion of this gland contains citric acid and enzymes which nourish and activate the spermatozoa to swim.

A pair of the bulbourethral gland- It is present on either side of the membranous urethra. They secrete an alkaline fluid. They also secrete mucus that lubricates the end of the penis and the lining of the urethra.

Question 12. What is oogenesis? Give a brief account of oogenesis.

Answer: The formation of ovum from oogonia in females takes place by a process called oogenesis, which occurs in the ovary. During the process a diploid oogonium or egg mother cells increases in size and transforms into a diploid primary oocyte, the later then undergoes meiosis I or reductional division to form two unequal haploid cells. The smaller cell is called “first polar body” and the larger cell is called “secondary oocyte”. The secondary oocyte undergoes meiosis II or equational division to form a secondary polar body and an ovum.

Flow chart presentation of oogenesis :

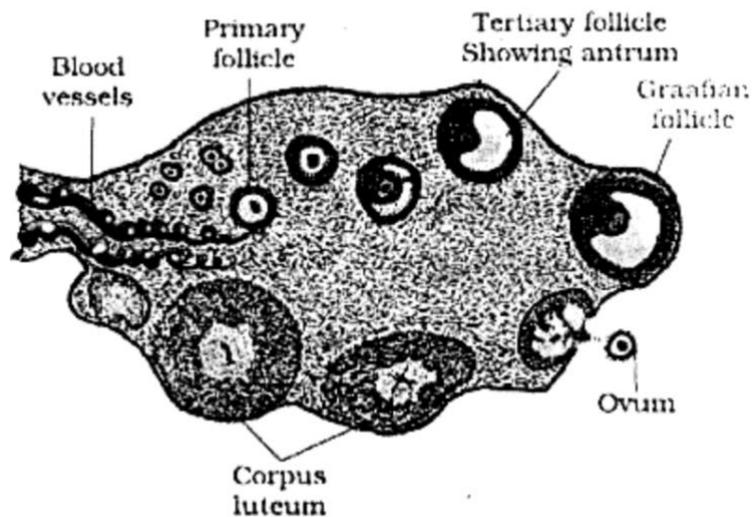


Oogenesis in human female showing formation of ovum

Question 13. Draw a labelled diagram of a section through ovary.

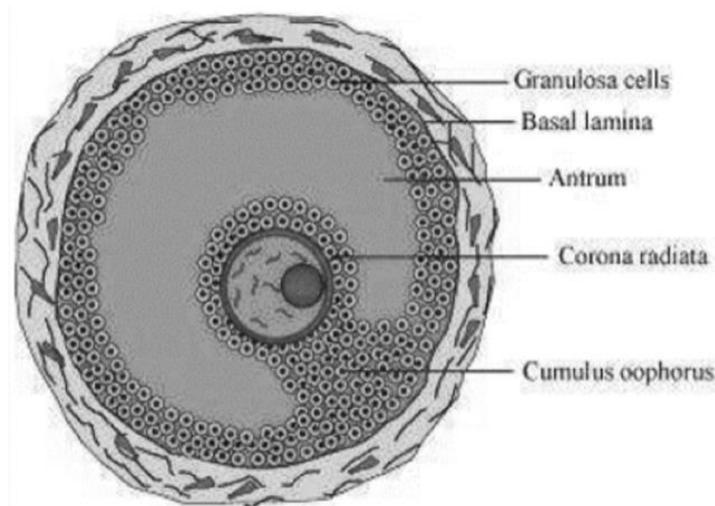
Answer: The section of the ovary is given below:

Diagram of section through ovary



Question 14. Draw a labelled diagram of a Graafian follicle.

Answer:



Structure of the Graafian follicle

Question 15. Name the functions of the following:

(a) Corpus luteum (b) Endometrium

(c) Acrosome (d) Sperm tail

(e) Fimbriae

Answer: a) Corpus luteum – is the outcome of ruptured Graffian follicle, it secretes progesterone hormone during menstrual cycle in luteal phase. Excessive secretion of progesterone prevents ovulation by inhibiting secretions of FSH and LT. it also allows endometrium to proliferate and prepare itself for implantation.

b) Endometrium – is the innermost wall/linig of the uterus which is rich in glands and it undergoes cyclic changes during the phases of menstrual cycle to prepare itself for implantation of the embryo.

c) Acrosome – is a cap-like structure which is present in the anterior part of the sperm, containing hyaluronidase enzyme, that hydrolyses the outer membrane of the egg, hence helping the sperm to penetrate the egg at the time of fertilization.

d) Sperm tail – is the longest region of the sperm that facilitates the movement of the sperm inside the female reproductive tract.

e) Fimbriae – are finger like projections present at the end of ovary in the fallopian tube, these helps in

the collection of ovum by beating their cilia (after ovulation).

Question 16. Identify True/False statements. Correct each false statement to make it true.

- (a) Androgens are produced by Sertoli cells. (True/False)
- (b) Spermatozoa get nutrition from Sertoli cells. (True/False)
- (c) Leydig cells are found in the ovary. (True/False)
- (d) Leydig cells synthesise androgens. (True/False)
- (e) Oogenesis takes place in corpus luteum. (True/False)
- (f) Menstrual cycle ceases during pregnancy. (True/False)
- (g) Presence or absence of hymen is not a reliable indicator of virginity or sexual experience. (True/False)

Answer: (a) Androgens are produced by Sertoli cells. (False)

Androgens are produced by Leydig cells found in seminiferous tubules of the testis.

- (b) Spermatozoa get nutrition from Sertoli cells. (True)
- (c) Leydig cells are found in ovary. (False)

Leydig cells are found in the seminiferous tubules of the testis.

- (d) Leydig cells synthesise androgens. (True)
- (e) Oogenesis takes place in corpus luteum. (False)

Oogenesis takes place in the ovary.

- (f) Menstrual cycle ceases during pregnancy. (True)
- (g) Presence or absence of the hymen is not a reliable indicator of virginity or sexual experience. (True).

Question 17. What is menstrual cycle? Which hormones regulate menstrual cycle?

Answer: **Menstrual cycle:** The reproductive cycles in female primates is called the menstrual cycle. In a 28 days menstrual cycle, the menses takes place on cycle days 3-5. The menstrual cycle consists of phases like menstrual phase, follicular phase, ovulatory phase and luteal phase.

Menstrual phase

1. The production of LH from the anterior lobe of the pituitary gland is reduced.
2. The withdrawal of this hormone causes degeneration of the corpus luteum and, therefore progesterone production is reduced.
3. Production of oestrogen is also reduced in this phase.
4. The endometrium of the uterus breaks down & menstruation begins.
5. The cells of endometrium secretions, blood & unfertilised ovum constitute the menstrual flow.

Follicular phase-

1. This phase usually includes cycle days 6-13 or 14 in a 28 days cycle.
2. The follicle stimulating hormone (FSH) secreted by the anterior lobe of the pituitary gland stimulates the ovarian follicle to secrete oestrogens.
3. Oestrogen stimulates the proliferation of the endometrium of the uterine wall.
4. The endometrium becomes thicker by rapid cell multiplication and this is accompanied by an increase in uterine glands & blood vessels.

Ovulatory phase

1. Both LH & FSH attain a peak level in the middle of the cycle (about 14th day).
2. Oestrogen concentration in blood increases.
3. Rapid secretion of LH induces rupturing of the graffian follicle and thereby the release of the ovum. In fact, LH causes ovulation.

Luteal Phase:

1. Includes cycle days 15 to 28.
2. Corpus luteum secretes progesterone.

3. Endometrium thickens.
4. Uterine glands become secretory.

Hormonal control of the menstrual cycle.

1. FSH stimulates the ovarian follicles to produce oestrogens.
2. LH stimulates corpus luteum to secrete progesterone.
3. Menstrual phase is caused by the increased production of oestrogens.
4. LH causes ovulation
5. The proliferative phase is caused by the increased production of oestrogens.
6. The secretory phase is caused by increased production of progesterone.

Question 18. What is parturition? Which hormones are involved in induction of parturition?

Answer: Parturition is the act of giving birth to the young; childbirth. Fully developed foetus and placenta send signals for parturition which in turn induces mild uterine contractions by stretching of cervix referred to as foetal ejection reflex. Stretching of cervix exerts positive feedback on the posterior pituitary to secrete oxytocin. Oxytocin exhibits both direct and indirect (via prostaglandins) effect on the uterus to facilitate uterine contractions to push the foetus downward which in turn stretches cervix more and leads to childbirth. Relaxin is secreted by corpus luteum at the end of pregnancy. It serves to relax the pelvic ligament and cervix to facilitate the birth of young one.

Question 19. In our society the women are often blamed for giving birth to daughters. Can you explain why this is not correct?

Answer: Spermatogenesis is the process of the production of sperms from the immature male germ cells. It starts at puberty and usually continues uninterrupted until death, although a slight decrease in the quantity of sperm is seen with increase in age.

Process of Spermatogenesis:

The spermatogonia (2N) present at the inner side of the seminiferous tubules multiply by mitotic divisions and increase in number. They stop undergoing mitosis, grow and become primary spermatocytes (2N). Each primary spermatocyte undergoes meiosis to form two equal haploid

secondary spermatocytes (N). Each secondary spermatocyte then undergoes second meiotic division to form four equal haploid cells called spermatids (N). Spermatids receive nourishment to form sperms by the process called spermiogenesis.

Question 20. How many eggs are released by a human ovary in a month? How many eggs do you think would have been released if the mother gave birth to identical twins? Would your answer change if the twins born were fraternal?

Answer: Only one egg is released by a human ovary in a month.

Identical twins are produced a single egg by separation of early blastomeres resulting from first zygotic cleavage.

If the twins born were fraternal, then twins would have developed from two separate eggs. As a result, two eggs are released from ovary and get fertilized by two sperms. Hence young baby may have separate gene and are known to be fraternal twins.

Question 21. How many eggs do you think were released by the ovary of a female dog which gave birth to 6 puppies?

Answer: The ovaries of a female dog must have released 6 eggs, each of which gets fertilized and so six zygotes are formed, each of which develops in to a puppy.

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