CHAPTER

# 2

# HUMAN REPRODUCTION

CLASS 12TH

NCERT EXERCISE AND SOLUTIONS - BIOLOGY



**Q. 1. Fill in the blanks:**

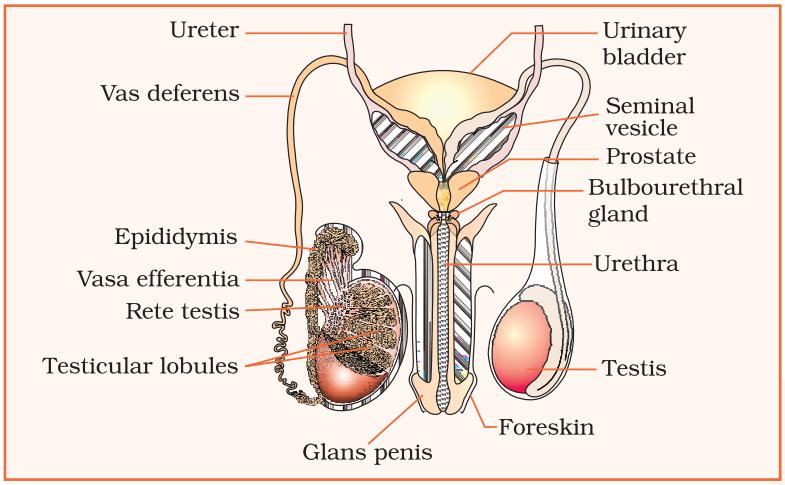
**(a) Humans reproduce _____ (asexually/sexually)**
**(b) Humans are _____ (oviparous, viviparous, ovoviviparous)**
**(c) Fertilisation is _____ in humans (external/internal)**
**(d) Male and female gametes are _____ (diploid/haploid)**
**(e) Zygote is _____ (diploid/haploid)**
**(f) The process of release 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) sexually
(b) viviparous
(c) internal
(d) haploid
(e) diploid
(f) ovulation
(g) luteinising hormone (LH)
(h) fertilisation
(i) ampulla of the oviduct
(j) blastocyst
(k) placenta

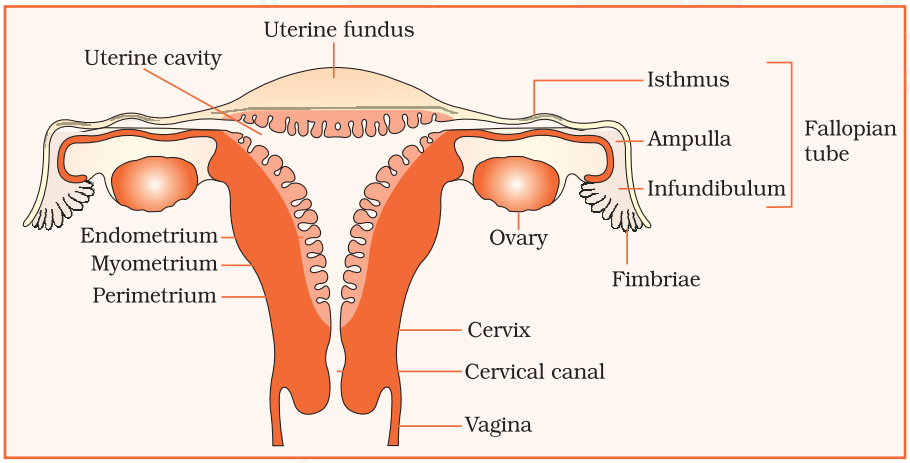
**Q. 2.** **Draw a labelled diagram of male reproductive system.**

**ANSWER:-**




**Q. 3.** **Draw a labelled diagram of female reproductive system.**

**ANSWER:-**




**Q. 4.** **Write two major functions each of testis and ovary.**

**ANSWER:-**

The testis and ovary perform two primary functions:

**Testis:**

- Spermatogenesis occurs in the seminiferous tubules, producing sperm.
- Leydig cells secrete testosterone, the male sex hormone.

**Ovary:**

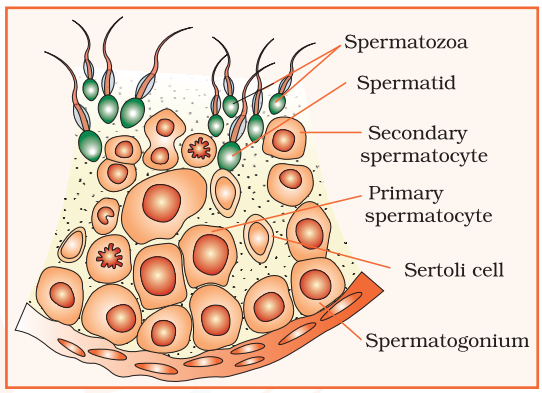
- Oogenesis takes place in the ovaries, leading to the production of ova.
- The ovaries secrete the female sex hormones, progesterone and estrogen.

**Q.5. Describe the structure of a seminiferous tubule.**

**ANSWER:-**

The structure of the seminiferous tubules is as follows:

- Seminiferous tubules are located in the testicular lobules and are highly coiled. This is the site where sperm production occurs in the testes.
- Each seminiferous tubule is lined with germinal epithelium.
- On the inner side, the tubule is lined with two types of cells: Sertoli cells and spermatogonia.
  - **Spermatogonia** are the male germ cells that produce primary spermatocytes through meiotic divisions. These primary spermatocytes undergo meiosis to form secondary spermatocytes, which then develop into spermatids. Spermatids later transform into spermatozoa, the mature male gametes.
  - **Sertoli cells**, also known as nurse cells, nourish the germ cells during their development.




- Adjacent to the seminiferous tubules are large polygonal cells called **Leydig cells** (or interstitial cells), which secrete testosterone, the male sex hormone.

**Q.6. What is spermatogenesis? Briefly describe the process of spermatogenesis.**

**ANSWER:-**

The process of sperm production from an immature germ cell in males is called spermatogenesis. It occurs in the seminiferous tubules within the testes. During spermatogenesis, a diploid male germ cell, or spermatogonium, enlarges to form a diploid primary spermatocyte, which then undergoes the first meiotic division (meiosis I). This division is a reductional process that results in two equal haploid secondary spermatocytes. Each secondary spermatocyte undergoes a second meiotic division (meiosis II), producing two equal haploid spermatids.

In total, four haploid spermatids are produced from a single diploid spermatogonium. These spermatids then undergo transformation into spermatozoa (sperm) through the process of spermiogenesis.

**Q. 7. Name the hormones involved in regulation of spermatogenesis.**

**ANSWER:-**

The hormones involved in the regulation of spermatogenesis are as follows:

- **Luteinizing hormone (LH):** It stimulates Leydig cells to synthesize and secrete androgens.
- **Gonadotropin-releasing hormone (GnRH):** Secreted by the hypothalamus during puberty, it acts on the anterior pituitary gland to stimulate the release of LH and FSH.

- **Follicle-stimulating hormone (FSH):** It acts on Sertoli cells, prompting the secretion of factors that support the process of spermiogenesis.
- **Androgens:** These hormones stimulate the production of inhibin, which helps regulate spermatogenesis.

**Q. 8. Define spermiogenesis and spermiation.**

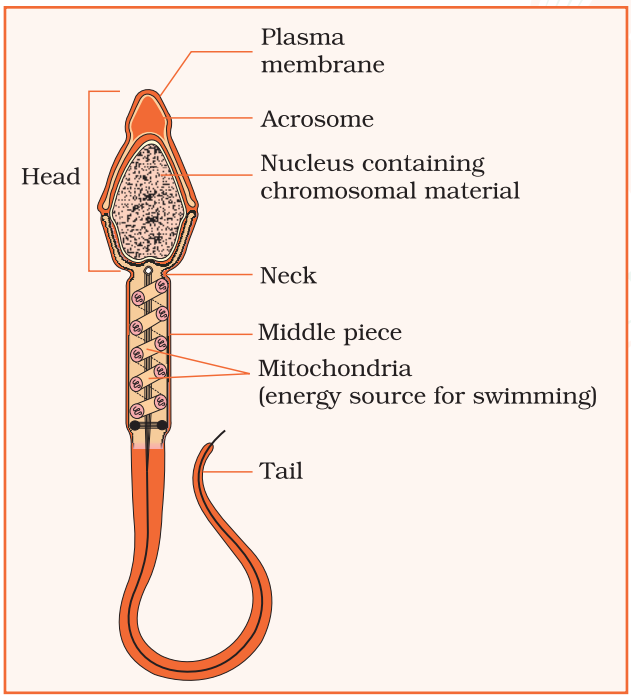
**ANSWER:-**

**Spermiogenesis:** This refers to the process in which non-motile spermatids are transformed into mature, motile spermatozoa.

**Spermiation:** This is the process in which mature spermatozoa are released from the Sertoli cells into the lumen of the seminiferous tubules within the testes.

**Q.9. Draw a labelled diagram of sperm.**

**ANSWER:-**




**Q. 10. What are the major components of seminal plasma?**

**ANSWER:-**

The primary components of seminal plasma include:

- Secretions from the male accessory sex glands, such as the prostate gland, seminal vesicles, and bulbourethral glands.
- It mainly contains calcium, fructose, and various enzymes.

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

**ANSWER:-**

The major functions of the male accessory ducts and glands, including the **rete testis** and **vasa efferentia**, are as follows:

i. **Seminal Vesicles:** These glands produce a viscous secretion rich in fructose, which provides energy to sperm and enhances their motility.

ii. **Prostate Gland:** The prostate secretes an alkaline fluid that neutralizes the acidic environment of the female reproductive tract, protecting sperm and aiding their movement.

iii. **Bulbourethral Glands (Cowper's Glands):** These glands release a clear, alkaline mucus that lubricates the urethra and neutralizes any acidic urine residue, ensuring a safe passage for sperm.

iv. **Vas Deferens (Ductus Deferens):** The vas deferens transports sperm from the epididymis to the urethra during ejaculation.

v. **Epididymis:** The epididymis stores and matures sperm, allowing them to gain motility and the ability to fertilize an egg.

vi. **Rete Testis:** The rete testis acts as a network of tubules that collects sperm from the seminiferous tubules and transports it to the vasa efferentia.

vii. **Vasa Efferentia:** These ducts carry sperm from the rete testis to the epididymis, where sperm further mature and are stored.

Together, these structures work in coordination to produce, store, and transport sperm, while also secreting fluids that nourish, protect, and facilitate sperm motility and fertilization.

**Q. 12. What is oogenesis? Give a brief account of oogenesis.**

**ANSWER:-**

Oogenesis is the process through which haploid female gametes, known as **ova**, are formed from diploid oogonia in the ovary, specifically within the Graafian follicles. This process is discontinuous, beginning during fotal development and only completing after puberty.

Oogenesis occurs in three phases:

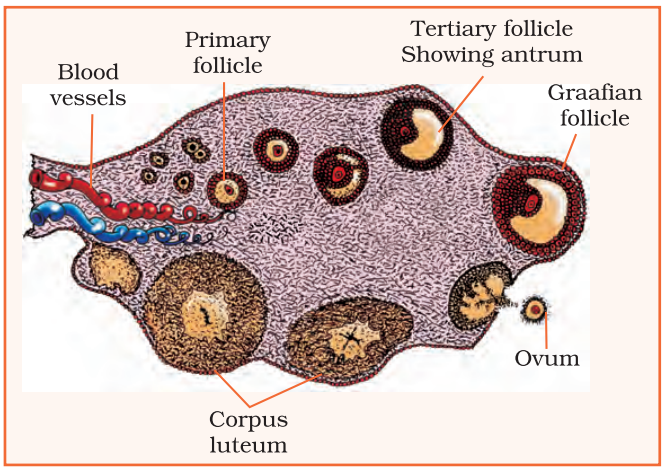
i. **Multiplicative Phase:** Follicle cells differentiate from the germinal epithelium of the ovary through repeated mitotic divisions. Some of these follicle cells enlarge and become egg mother cells, which divide mitotically to form oogonia.

ii. **Growth Phase:** One oogonium from the egg nest differentiates, while the others develop into surrounding follicular epithelium. The selected oogonium increases in size as it is nourished by the surrounding follicle cells, transforming into a diploid primary oocyte.

iii. **Maturation Phase:** The diploid primary oocyte undergoes two meiotic divisions during this phase. In **Meiosis I**, the primary oocyte divides into two haploid cells, with the larger one becoming the secondary oocyte and the smaller one becoming the polar body. In **Meiosis II**, the secondary oocyte divides into one large ootid and a second, smaller polar body. The first polar body also divides through mitosis to form two additional polar bodies. The ootid matures into a functional haploid ovum. As a result, one primary oocyte produces one large ovum and three polar bodies, which degenerate since they do not contribute to reproduction, leaving behind one functional ovum.

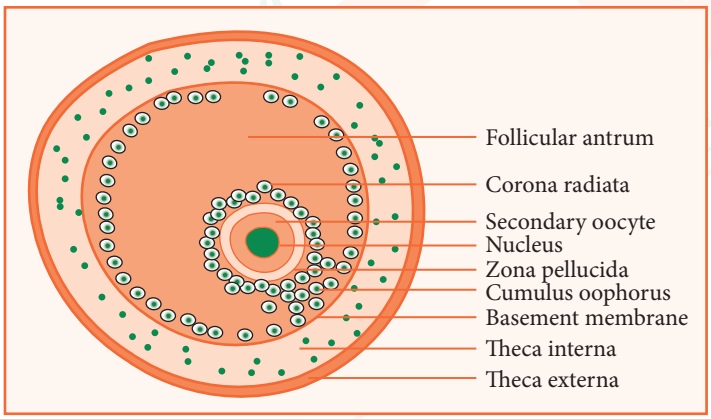
**Q. 13. Draw a labelled diagram of a section through ovary.**

**ANSWER:-**




**Q. 14. Draw a labelled diagram of a Graafian follicle?**

**ANSWER:-**




**Q. 15. Name the functions of the following:**

**(a) Corpus luteum**
**(b) Endometrium**
**(c) Acrosome**
**(d) Sperm tail**
**(e) Fimbriae**

**ANSWER:-**

The functions of the following structures are as described:

**(a) Corpus Luteum:** This structure forms after the Graafian follicle ruptures. During the luteal phase of the menstrual cycle, the corpus luteum secretes the hormone progesterone. High levels

of progesterone inhibit the secretion of LH and FSH, which prevents further ovulation. The corpus luteum also helps the endometrium of the uterus proliferate and prepare for potential implantation.

(b) **Endometrium:** The endometrium is the innermost lining of the uterus, composed of glands that undergo cyclic changes throughout the menstrual cycle. These changes prepare the endometrium for embryo implantation.

(c) **Acrosome:** Located at the anterior end of the sperm's head, the acrosome is a cap-like structure that contains the enzyme hyaluronidase. This enzyme helps hydrolyze the outer membrane of the egg, allowing the sperm to penetrate and fertilize the egg.

(d) **Sperm Tail:** The tail of the sperm is its longest part, playing a crucial role in enabling sperm motility once it enters the female reproductive tract.

(e) **Fimbriae:** These finger-like projections at the ovarian end of the fallopian tube assist in capturing the ovum after ovulation. This process is aided by the ciliary movement of the fimbriae.

**Q. 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 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) False, Androgens are produced by Leydig cells
(b) True
(c) False, Leydig cells are found in seminiferous tubules of testis in ovary
(d) True
(e) False, oogenesis occurs in ovary
(f) True
(g) True

**Q. 17. What is menstrual cycle? Which hormones regulate menstrual cycle?**

**ANSWER:-**

The menstrual cycle is a series of cyclic physiological changes that occur in the female reproductive tract, typically lasting around 28 days. It concludes with the shedding of the uterine lining, which is expelled as blood and mucus through the vaginal opening, known as menses.

The menstrual cycle is regulated by hormones including LH (luteinizing hormone), FSH (follicle-stimulating hormone), estrogen, and progesterone.

During the **follicular phase**, the secretion of LH and FSH from the anterior pituitary gland increases. FSH, stimulated by releasing hormones (RH) from the hypothalamus, promotes the development of the primary follicle into a Graafian follicle. As the levels of LH rise, the follicle grows and secretes estrogen.

Estrogen inhibits further secretion of FSH and triggers the release of LH, which also leads to the thickening of the uterine endometrium. The surge in LH causes the Graafian follicle to rupture and release the ovum into the fallopian tube.

After ovulation, the ruptured Graafian follicle transforms into the **corpus luteum**, which secretes progesterone during the **luteal phase**. Progesterone plays a crucial role in maintaining the endometrium and preparing it for potential embryo implantation.

High progesterone levels inhibit the secretion of FSH and LH, preventing further ovulation.

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

**ANSWER:-**

Parturition is the process through which a fully developed fetus is expelled from the mother's womb after the completion of the gestation period.

Two key hormones involved in initiating parturition are:

- **Oxytocin:** This hormone stimulates the contraction of the smooth muscles in the myometrium of the uterus, guiding the fully developed fetus toward the birth canal for delivery.
- **Relaxin:** It relaxes the pelvic ligaments, allowing the pelvis to widen and facilitating an easier childbirth process.

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

**ANSWER:-**

Humans have 23 pairs of chromosomes, with 22 pairs being autosomes, and the last pair determining biological sex. Males are heterogametic, producing two types of sperm: 50% carry the 'X' chromosome, and the other 50% carry the 'Y' chromosome. In contrast, females are homogametic, producing only one type of gamete, the ovum, each carrying the 'X' chromosome.

When the male and female gametes fuse to form a zygote, it will carry either an XX or XY chromosome combination, depending on whether the sperm carrying the 'X' or 'Y' chromosome fertilizes the ovum. If the sperm carrying the 'X' fertilizes the ovum (XX zygote), a female baby will develop, while if the sperm carrying the 'Y' fertilizes the ovum (XY zygote), a male baby will develop. Therefore, the sex of the child is determined by the sperm contributed by the father, not the mother. This clarifies that the gender of the child is not something for which women should be blamed.

**Q. 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:-**

Generally, human ovaries release only one egg per month, with the release of two eggs being a rare occurrence.

In the case of identical (monozygotic) twins, one egg is released by the ovary, which then splits into two after fertilization. This results in identical twins sharing the same genetic makeup. Conversely, in fraternal (dizygotic) twins, two eggs are released and fertilized by two different sperm cells, leading to fraternal twins having distinct genetic traits.

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

**ANSWER:-**

For the female dog to give birth to six puppies, her ovary released six eggs. As a result, six zygotes were formed, with each one developing into a separate puppy.