

Human Reproduction

NCERT Exemplar Solutions

Multiple Choice Questions (MCQs)

1. Choose the incorrect statement from the following

- (a) In birds and mammals internal fertilisation takes place
- (b) Colostrum contains antibodies and nutrients
- (c) Polyspermy is prevented by the chemical changes in the egg surface
- (d) In the human female implantation occurs almost seven days after fertilisation

Ans: (c) polyspermy is prevented by the chemical changes in the egg surface

2. Identify the wrong statement from the following.

- (a) High levels of estrogen trigger the ovulatory surge.
- (b) Oogonial cells start to proliferate and give rise to functional ova in regular cycles from puberty onwards.
- (c) Sperms released from seminiferous tubules are poorly motile/ non-motile.
- (d) Progesterone level is high during the post-ovulatory phase of menstrual cycle.

Ans: (b) Oogonial cells start to proliferate and give rise to functional ova in regular cycles from puberty onwards.

3. Spot the odd one out from the following structures with reference to the male reproductive system

- (a) Rete testis
- (b) Epididymis
- (c) Vasa efferentia
- (d) Isthmus

Ans: (d) Isthmus

4. Seminal plasma, the fluid part of semen, is contributed by

I. Seminal vesicle

II. Prostate

III. Urethra

IV. Bulbourethral gland

- (a) I and II
- (b) I, II and IV
- (c) II, III and IV

(d) I an IV

Ans: (b) I, II and IV

5. Spermiation is the process of the release of sperms from

- (a) seminiferous tubules
- (b) vas deferens
- (c) epididymis
- (d) prostate gland

Ans: (a) seminiferous tubules

6. Mature Graafian follicle is generally present in the ovary of a healthy human female around

- (a) 5-8 day of menstrual cycle
- (b) 11-17 day of menstrual cycle
- (c) 18-23 day of menstrual cycle
- (d) 24-28 day of menstrual cycle

Ans: (b) 11-17 day of menstrual cycle

7. Acrosomal reaction of the sperm occurs due to

- (a) its contact with zona pellucida of the ova
- (b) reactions within the uterine environment of the female
- (c) reactions within the epididymal environment of the male
- (d) androgens produced in the uterus

Ans: (c) reactions within the epididymal environment of the male

8. Which one of the following is not a male accessory gland?

- (a) Seminal vesicle
- (b) Ampulla
- (c) Prostate
- (d) Bulbourethral gland

Ans: (b) Ampulla

9. The immature male germ cell undergo division to produce sperms by the process of spermatogenesis. Choose the correct one with reference to above.

- (a) Spermatogonia have 46 chromosomes and always undergo meiotic cell division
- (b) Primary spermatocytes divide by mitotic cell division

(c) Secondary spermatocytes have 23 chromosomes and undergo second meiotic division

(d) Spermatozoa are transformed into spermatids

Ans: (b) Primary spermatocytes divide by mitotic cell division

10. Match between the following representing parts of the sperm and their functions and choose the correct option.

Column I	Column II
A. Head	1. Enzymes
B. Middle piece	2. Sperm motility
C. Acrosome	3. Energy
D. Tail	4. Genetic material

(a) A-2, B-4, C-1, D-3

(b) A-4, B-3, C-1, D-2

(c) A-4, B-1, C-2, D-3

(d) A-2, B-1, C-3, D-4

Ans: (b) A-4, B-3, C-1, D-2

11. Which among the following has 23 chromosomes?

(a) Spermatogonia

(b) Zygote

(c) Secondary oocyte

(d) Oogonia

Ans: (c) Secondary oocyte

12. Match the following and choose the correct options.

Column I	Column II
A. Trophoblast	1. Embedding of blastocyst in the endometrium
B. Cleavage	2. Group of cells that would differentiate as embryo
C. Inner cell mass	3. Outer layer of blastocyst attached to the endometrium

D. Implantation	4. Mitotic division of zygote
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- (a) A-2, B-1, C-3, D-4
- (b) A-3, B-4, C-2, D-1
- (c) A-3, B-1, C-2, D-4
- (d) A-2, B-4, C-3, D-1

Ans: (b) A-3, B-4, C-2, D-1

13. Which of the following hormones is not secreted by human placenta?

- (a) hCG
- (b) Estrogens
- (c) Progesterone
- (d) LH

Ans: (d) LH-Luteizing Hormone

14. The vas deferens receives duct from the seminal vesicle and opens into urethra as

- (a) epididymis
- (b) ejaculatory duct
- (c) efferent ductule
- (d) ureter

Ans: (b) ejaculatory duct

15. Urethral meatus refers to the

- (a) urinogenital duct
- (b) opening of vas deferens into urethra
- (c) external opening of the urinogenital duct
- (d) muscles surrounding the urinogenital duct

Ans: (c) external opening of the urinogenital duct

16. Morula is a developmental stage

- (a) between the zygote and blastocyst
- (b) between the blastocyst and gastrula
- (c) after the implantation
- (d) between implantation and parturition

Ans: (a) between the zygote and blastocyst

17. The membranous cover of the ovum at ovulation is

- (a) corona radiata
- (b) zona radiata
- (c) zona pellucida
- (d) chorion

Ans: (a) corona radiata.

18. Identify the odd one from the following

- (a) labia minora
- (b) fimbriae
- (c) infundibulum
- (d) isthmus

Ans: (a) labia minora.

Very Short Answer Type Questions

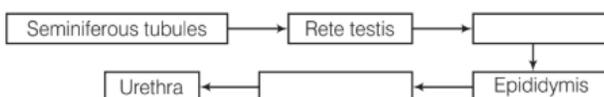
1. Given below are the events in human reproduction. Write them in the correct sequential order.

Insemination, gametogenesis, fertilisation, parturition, gestation, implantation.

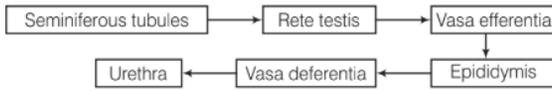
Ans: The reproductive events in humans include

- Gametogenesis: Formation of gametes (sperm in males, ova in females).
- Insemination: Transfer of sperm into the female reproductive tract.
- Fertilisation: Fusion of male and female gametes.
- Implantation: Formation, development, and then attachment of the blastocyst to the uterine wall.
- Gestation: Embryonic development inside the female body.
- Parturition: Delivery of the baby.

2. The path of sperm transport is given below. Provide the missing steps in blank boxes.



Ans:



3. What is the role of cervix in the human female reproductive system?

Ans:

- The fundus is the broad, curved, dome-shaped upper area that receives the Fallopian tubes.
- The body is the main part of the uterus, which starts directly below the level of the Fallopian tubes and continues downward until the uterine walls and cavity begin to narrow.
- The isthmus is the lower, narrow neck region.
- The cervix is the lowest part that extends downward from the isthmus until it opens into the vagina.

4. Why are menstrual cycles absent during pregnancy?

Ans: The menstrual flow results from the breakdown of the endometrial lining of the uterus and its blood vessels, which forms liquid that comes out through the vagina. Menstruation only occurs if the released ovum is not fertilized. During pregnancy, all events of the menstrual cycle stop, and the corpus luteum secretes large amounts of progesterone, which is essential for the maintenance of the endometrium. These changes lead to no menstruation during pregnancy.

5. Female reproductive organs and associated functions are given below in columns I and II. Fill in the blanks.

Column I	Column II
Ovaries	Ovulation
Oviduct	A
B	Pregnancy
Vagina	Birth

Ans:

- A- Fertilisation
- B- Uterus

6. From where the parturition signals arise-mother or foetus? Mention the main hormone involved in parturition.

Ans: Parturition is induced by a complex neuroendocrine mechanism. The signals for parturition originate from the fully developed foetus and the placenta, which induce mild uterine contractions called foetal ejection reflex.

The hormone involved in parturition is oxytocin which acts on the uterine muscle and causes stronger uterine contractions. This leads to the expulsion of the baby out of the uterus through the birth canal.

7. What is the significance of epididymis in male fertility?

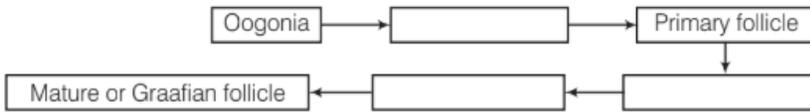
Ans: The epididymis helps the sperm in attaining maturity, acquiring increased motility, and fertilising capacity. It also stores sperm for a short period before entering the vas deferens. The epididymis shows peristaltic and segmenting contractions at intervals to push the sperm away from the testis.

8 Give the names and functions of the hormones involved in the process of spermatogenesis. Write the names of the endocrine glands from where they are released.

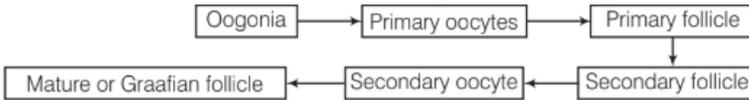
Ans: Hormones involved in spermatogenesis are

Hormone	Function	Gland
Gonadotropin-releasing hormone (GnRH)	Acts on the pituitary to secrete LH and FSH.	Hypothalamus
Luteinizing Hormone (LH)	Acts on Leydig cells and stimulates synthesis and secretion of androgens	Pituitary
Androgens	Stimulate the process of spermatogenesis	Testis
Follicle Stimulating Hormone (FSH)	Acts on Sertoli cells and stimulates the secretion of some factors that help in the process of spermiogenesis	Pituitary

9. The mother germ cells are transformed into a mature follicle through series of steps. Provide the missing steps in the blank boxes.



Ans:



10. During reproduction, the chromosome number ($2n$) reduces to half (n) in the gametes and again the original number ($2n$) is restored in the offspring. What are the processes through which these events take place?

Ans: The meiotic cell division reduces the chromosome numbers to half during gametogenesis, and the diploid ($2n$) number of chromosomes is restored by the union of male and female gamete through the process of fertilisation.

11. What is the difference between a primary oocyte and a secondary oocyte?

Ans: Primary oocyte is a diploid cell formed in the foetal ovary when the gamete mother cell, oogonia, is arrested at prophase-I of meiosis. Secondary oocyte is the haploid cell formed from a primary oocyte that completes its first meiotic division during puberty and produces the female gamete ova(n).

12. What is the significance of ampullary-isthmic junction in the female reproductive tract?

Ans: The act of fertilisation takes place in the female genital tract, that is, at the junction of the isthmus and ampulla (ampullary-isthmic junction) of the Fallopian tube.

13. How does zona pellucida of ovum help in preventing polyspermy?

Ans: When a sperm penetrates an ovum, it induces changes in the membrane that make the zona pellucida layer impenetrable to additional sperm. Thus, it ensures that only one sperm can fertilise an ovum and stops polyspermy.

14. Mention the importance of LH surge during menstrual cycle.

Ans: Rapid secretion of LH leading to its maximum level during the mid menstrual cycle (14th day), called the LH surge, induces rupture of the Graafian follicle and thereby the release of the ovum (ovulation).

The ovulation (ovulatory phase) is followed by the luteal phase, during which the remaining parts of the Graafian follicle transform into the corpus luteum. The corpus luteum secretes large amounts of progesterone, which is essential for the maintenance of the endometrium. Such an endometrium is necessary for implantation of the fertilised ovum and other events of pregnancy.

15. Which type of cell division forms spermatids from the secondary spermatocytes?

Ans: The secondary spermatocytes undergo the second meiotic division to produce four equal, haploid spermatids.

Short Answer Type Questions

1. A human female experiences two major changes, menarche and menopause during her life. Mention the significance of both the events.

Ans: In human beings, initiation of menstruation at puberty (between ages 9-15 years) is called menarche. While menstrual cycles cease around 50 years of age, that is termed as menopause. Menarche signifies the maturation and readiness of the female reproductive system for childbearing.

It marks the capability of the ovaries to produce a mature oocytes (female gamete) that can now be fertilised by the sperm, and also that the uterus is capable of supporting the foetal growth and development.

Menopause signifies the end of childbearing age. At this age supply of healthy eggs is very low, the levels of the hormones secreted by the ovaries decline, and menstruation stops. The uterus no longer remains conducive for foetal growth.

2. (a) How many spermatozoa are formed from one secondary spermatocyte?

(b) Where does the first cleavage division of zygote take place?

Ans:(a) A primary spermatocyte completes the first meiotic division (reduction division), leading to the formation of two equal, haploid cells called secondary spermatocytes ($n = 23$ chromosomes each). The secondary spermatocytes undergo the second meiotic division to produce four equal, haploid spermatids (n). Each spermatids produce spermatozoa.

(b) The mitotic division called cleavage starts 30 h after fertilisation when the zygote moves through the isthmus of of the Fallopian tube (oviduct) towards the uterus and forms blastomeres.

3. Corpus luteum in pregnancy has a long life. However, if fertilisation does not take place, it remains active only for 10-12 days. Explain.

Ans: The ruptured Graafian follicle transforms into the corpus luteum and secretes large amounts of progesterone, which is essential for the maintenance of the endometrium. Such an endometrium is required for the implantation of a fertilised ovum (blastocyst) and other events of pregnancy.

That's why the corpus luteum in pregnancy has a long life. But in the absence of fertilisation, maintenance of the endometrium is not required. Therefore, the corpus luteum degenerates within 10-12 days.

4. What is foetal ejection reflex? Explain how it leads to parturition?

Ans: Foetal ejection reflex encompasses the mild uterine contractions in response to the signals that originate from the fully developed foetus and the placenta. This triggers the release of oxytocin from the maternal pituitary. Oxytocin acts on the uterine muscle and causes stronger contractions, which in turn stimulate further secretion of oxytocin.

The stimulatory reflex between the uterine contraction and oxytocin secretion continues, resulting in stronger and stronger contractions leading to the expulsion of the baby out of the uterus through the birth canal.

5. Except endocrine function, what are the other functions of placenta.

Ans: Placenta is the structural and functional unit between the developing embryo (foetus) and the maternal body.

The placenta acts as an endocrine tissue and produces several hormones like human Chorionic Gonadotropin (hCG), human Placental Lactogen (hPL), estrogens, progesterones, etc. Other than the endocrine function, the placenta also facilitates the supply of oxygen and nutrients to the embryo and removes carbon dioxide and excretory/waste materials produced by the developing fetus.

6. Why doctors recommend breastfeeding during initial period of infant growth?

Ans: The milk produced during the initial few days of lactation is called colostrum, which contains several antibodies (especially IgA) essential to develop resistance in the newborn babies against diseases. Breastfeeding during the initial period of infant growth is recommended by doctors for bringing up a healthy baby.

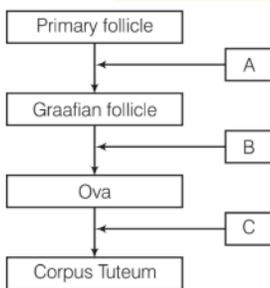
7. What are the events that take place in the ovary and uterus during follicular

phase of the menstrual cycle.

Ans: The major events of the menstrual cycle are the menstrual phase, the follicular phase, the ovulatory phase, and the luteal phase.

- During follicular phase, the primary follicles in the ovary grow to become a fully mature Graafian follicle, and simultaneously, the endometrium of the uterus regenerates through proliferation. These changes in the ovary and the uterus are induced by changes in the levels of pituitary and ovarian hormones.
- The secretion of gonadotropins (LH and FSH) increases gradually during the follicular phase and stimulates follicular development as well as the secretion of estrogens by the growing follicles.
- Both LH and FSH attain a peak level in the middle of the the cycle (about the 14th day). This rapid secretion of LH, leading to its maximum level, induces rupture of the Graafian follicle to release the ovum.

8. Given below is a flow chart showing ovarian changes during menstrual cycle. Fill in the spaces giving the name of the hormones responsible for the events shown.

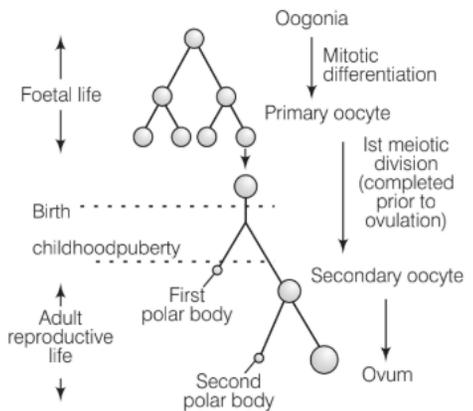


Ans:

- A. LH and FSH
- B. LH
- C. Progesterone

9. Give a schematic labelled diagram to represent oogenesis (without descriptions).

Ans:



10. What are the changes in the oogonia during the transition of a primary follicle to Graafian follicle?

Ans:

- The germinal epithelial cells divide repeatedly until many diploid oogonia are formed.
- The oogonia grow to form primary oocytes.
- Each primary oocyte then gets surrounded by a layer of granulosa cells and then called the primary follicle.
- The primary follicles get surrounded by more layers of granulosa cells and are called secondary follicles.
- The secondary follicle soon transforms into a tertiary follicle, which is characterised by a fluid-filled cavity called an antrum.
- The primary oocyte within the tertiary follicle undergoes meiotic division to become a secondary oocyte and a first polar body (haploid).
- The tertiary follicle further changes into the mature follicle or Graafian follicle that ruptures to release the secondary oocyte (ovum) from the ovary by the process called ovulation.

Long Answer Type Questions

1. What role do pituitary gonadotropins play during follicular and ovulatory phases of menstrual cycle? Explain the shifts in steroidal secretions.

Ans:

- Menstrual Phase (1-5 days): Endometrium breaks down the cells of endometrium secretions, unfertilised ovum constitute menstrual flow. Progesterone production is reduced.
- Follicular Phase (6-13 days): Endometrium rebuilds, FSH and oestrogen

secretion are increased.

- Ovulatory Phase (14-16 days): Both LH and FSH attain peak levels. The estrogen levels are also high. It leads to ovulation.
- Luteal Phase (16-28 days): In the absence of fertilisation corpus luteum secretes progesterone. The Endometrium Thickens, and the uterine glands become secretory. The menstrual cycle starts with the menstrual phase, when menstrual flow occurs, and it lasts for 3-5 days. It results from breakdown of the endometrial lining of the uterus and its blood vessels.
- Follicular Phase: The menstrual phase is followed by the follicular phase. During this phase, the primary follicles in the ovary grow to become a fully mature Graafian follicle and simultaneously the endometrium of the uterus regenerates through proliferation. These changes in the ovary and the uterus are induced by changes in the levels of pituitary and ovarian hormones.

The secretion of gonadotropins (LH and FSH) increases gradually during the follicular phase and stimulates follicular development as well as the secretion of estrogens by the growing follicles. Both LH and FSH attain a peak level in the middle of the cycle (about the 14th day).

Rapid secretion of LH, leading to its maximum level during the mid-cycle called the LH surge, induces rupture of the Graafian follicle and thereby the release of the ovum (ovulation). The ovulation (ovulatory phase) is followed by the luteal phase, during which the remaining parts of the Graafian follicle transform into the corpus luteum. The corpus luteum secretes large amounts of progesterone, which is essential for the maintenance of the endometrium.

Such an endometrium is necessary for implantation of the fertilised ovum and other events of pregnancy. In the absence of fertilisation, the corpus luteum degenerates. This causes the disintegration of the endometrium, leading to menstruation.

2. Meiotic division during oogenesis is different from that in spermatogenesis.

Explain how and why?

Ans: Oogenesis is different from spermatogenesis in the following aspects

Spermatogenesis	Oogenesis
Sperm generation starts at puberty.	Oocytes are generated before birth.
Many millions generated at a time.	Only one matures at a time, every month.

After two complete meiotic divisions, four equally sized cells were produced.	Meiosis-I gets arrested at prophase-I, and when completed at a later stage, one big cell with almost all the cytoplasm and three very small cells are produced.
They mature into flagellated and motile cells.	A mature ovum is non-flagellated and non-motile.

Reasons:

- (i) Unequal cell division makes the ovum much larger than the other three polar bodies. Because an ovum has more cytoplasm and more organelles, it has a better chance of surviving.
- (ii) The male makes millions of tiny sperms, while the female makes only one egg per month which also waits for the second meiotic division, until just before fertilisation. This is a way of conserving energy.
- (iii) Sperm is smaller and motile as it has to move out of the male system to the female reproductive system. A larger egg has abundant reserve food so that the embryo starts developing right after fertilisation.

3. The zygote passes through several developmental stages till implantation.

Describe each stage briefly with suitable diagrams.

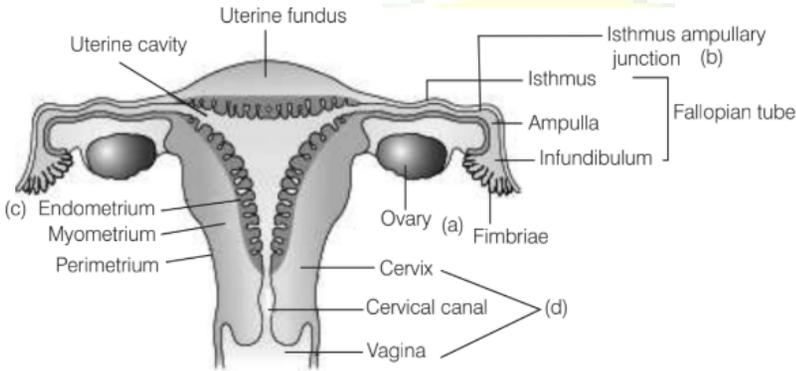
Ans: The zygote passes through the following stages till implantation

- (i) The embryo with 8-16 blastomeres is called a morula.
- (ii) The morula continues to divide and transforms into a blastocyst as it moves further into the uterus.
- (iii) The blastomeres in the blastocyst are arranged into a surface layer called the trophoblast, and a cluster of interior cells attached to the trophoblast is called the inner cell mass.
- (iv) The trophoblast layer then gets attached to the endometrium, and the inner mass cells get differentiated as embryos.
- (v) After attachment, the uterine cells divide rapidly to cover the blastocyst.
- (vi) The blastocyst becomes embedded in the uterine endometrium. This is called implantation.

4. Draw a neat diagram of the female reproductive system and label the parts associated with the following: (a) production of gamete, (b) site of fertilisation, (c)

site of implantation, and (d) birth canal.

Ans: The female reproductive system consists of a pair of ovaries along with a pair of oviducts, uterus, cervix, vagina, and the external genitalia located in the pelvic region. These parts are integrated structurally and functionally to support the processes of ovulation, fertilisation, pregnancy and birth.



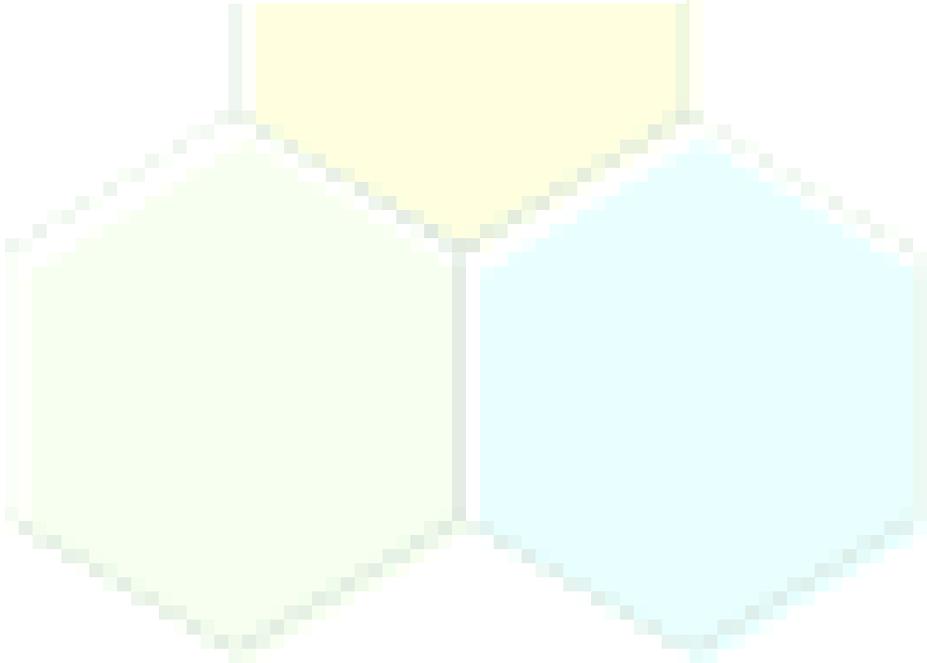
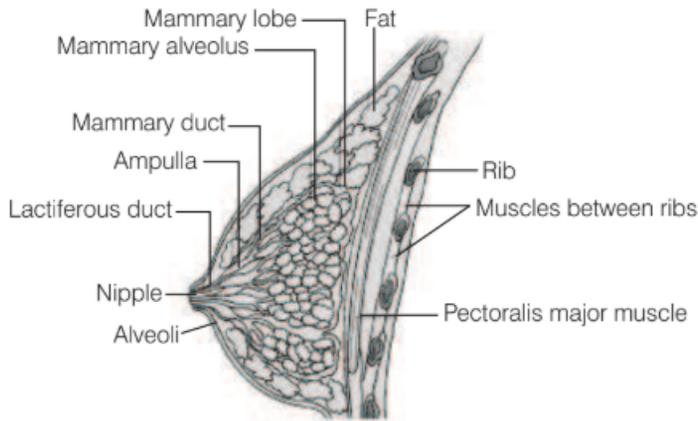
Labels

- (i) Ovary (production of gamete)
- (ii) Isthmus-ampullary junction(site of fertilisation)
- (iii) Uterine endometrium (site of implantation)
- (iv) Cervix and vagina (birth canal)

5. With a suitable diagram, describe the organisation of mammary gland.

Ans: The description of the mammary gland is as follows

- (i) The mammary glands are paired structures (breasts) that contain an undeveloped duct systems and adipose tissue (fat-containing cells).
- (ii) During pregnancy, in response to oestrogen and progesterone, a glandular system develops for milk production.
- (iii) Glandular tissue of each breast develops mammary lobes containing clusters of cells called alveoli.
- (iv) The cells of alveoli secrete milk, which is stored in the cavities (lumens) of alveoli
- (v) The alveoli open into mammary tubules. The tubules of each lobe join to form a mammary duct.
- (vi) Several mammary ducts join to form a wider mammary ampulla, which is connected to the lactiferous duct through which milk is sucked out by the baby.



BioSmartNotes