NEET Important Questions with Solutions from Human Reproduction

Q.1. The correct sequence of various stages in embryonic development

A) Fertilization - Cleavage - Morula - Blastula - Gastrula

B) Cleavage - Fertilization - Gastrula - Blastula

C) Blastula - Cleavage - Gastrula - Fertilization

D) Gastrula - Fertilization - Cleavage - Blastula

Answer: Fertilization - Cleavage - Morula - Blastula - Gastrula

Solution: During sexual reproduction, the parental cells divide by meiosis to produce gametes which ultimately fuse together to produce a zygote. A zygote formed after **fertilization** is a diploid, unicellular structure that undergoes multiple divisions (**cleavage**) to form the embryo.

The embryo with 8 to 16 blastomeres is called a **morula** is formed which upon further division transforms into a **blastula** (blastocyst) and moves into the uterus to form a 36 celled stage called a **gastrula**. During gastrulation, three germ layers are formed and the embryo differentiates into an outer layer called ectoderm, an inner layer called endoderm and a middle mesoderm.

Q.2. The first stage with a haploid set of chromosomes can be seen during spermatogenesis in

A) primary spermatocyte

B) spermatid

C) secondary spermatocyte

D) spermatozoa

Answer: secondary spermatocyte

Solution: **SPERMATOGENESIS:**

During **spermatocytogenesis**, the diploid spermatogonia (2n) mitotically multiply and grow into diploid **primary spermatocytes (2n)**. These move into the maturation phase of spermatogenesis, where meiosis (reductional division) takes place.

- **Meiosis I -** The diploid (2n) primary spermatocyte completes meiosis-I leading to the formation of two equal, **haploid** cells called **secondary spermatocytes**. During this time the chromosomes undergo synapsis, tetrad formation, and crossing over.
- **Meiosis II -** The secondary spermatocytes further undergo a second meiotic division to produce four equal, haploid **spermatids**.

Meiosis-I and meiosis-II are together called the **maturation phase**.

The spermatids are then transformed into spermatozoa (sperms) by the process of metamorphosis called **spermiogenesis**. Each spermatid gives rise to one sperm.

Q.3. The 'semen' of a male human who has undergone 'vasectomy' is devoid of:

A) Secretions of prostate gland

B) Secretions of seminal vesicle

C) Sperms

D) Seminal plasma

Answer: Sperms

Solution: A vasectomy is an invasive, permanent form of birth control which leads to male sterilization. It is a surgical procedure in which the vas deferens on either sides of the testicles are cut and tied or sealed to prevent the sperm from being released outside during ejaculation. After the procedure, the testes continue to produce sperms. Since they cannot travel to the urethra due to the blockage of the vas deferens, the semen ejaculated is devoid of sperms.

Q.4. 'Acrosome' is a part of:

A) Middle piece

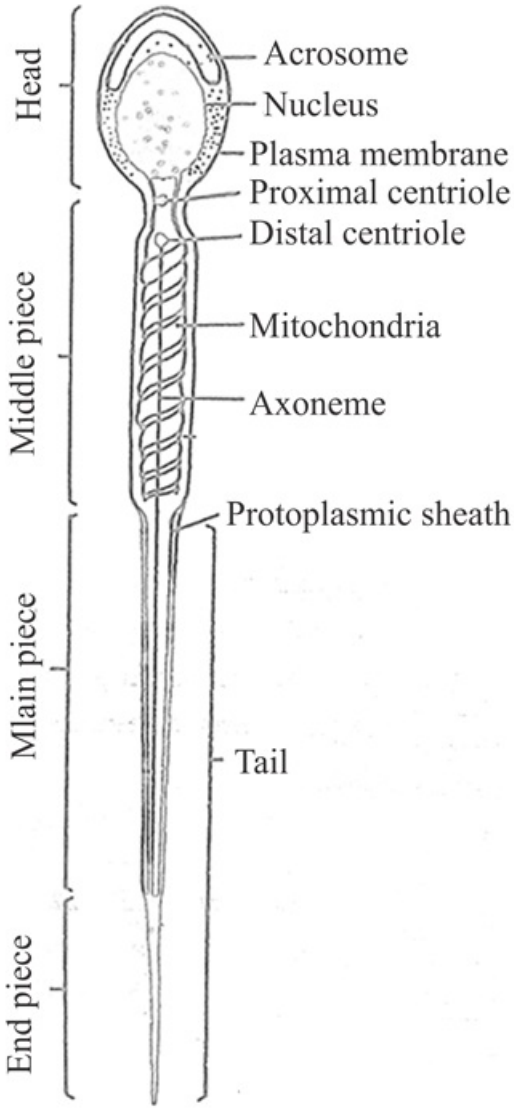
B) Neck

C) Head

D) Tail

Answer: Head

Solution: The acrosome and acrosomal cap together make up the acrosomal region of the **sperm head and is derived from Golgi apparatus**. It is located between two layers which are the plasma membrane and the nuclear membrane of the nucleus. The primary function of the acrosome is to recognize the egg cell and allow the sperm to penetrate the egg cell in order to fertilize it.



Q.5. After the development of antrum, the follicle becomes

A) Secondary follicle

B) Primary follicle

C) Tertiary follicle

D) Primordial follicle

Answer: Tertiary follicle

Solution: The secondary follicle acquires more layers of granulosa cells, and a fluid-filled cavity is formed within it; this cavity is known as the antrum and the structure is called the **tertiary follicle**. The antrum is a peculiar feature of the tertiary follicle, which further matures to form the Graafian follicle.

Q.6. Milk in mammary glands is stored in

A) reservoir

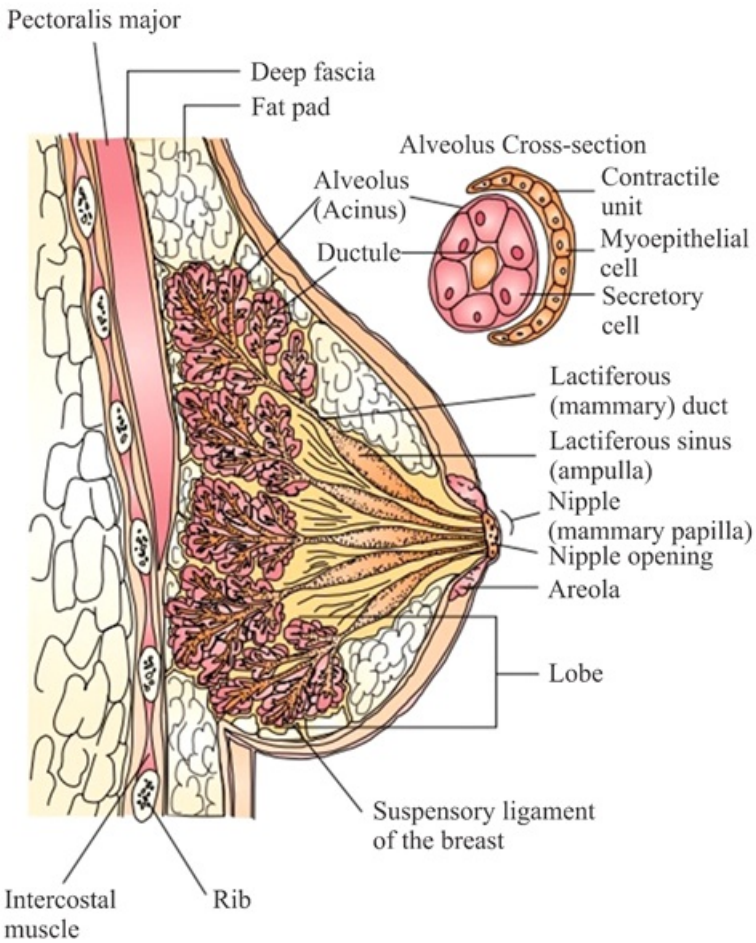
B) cells of alveoli

C) mammary sacs

D) cavities of alveoli

Answer: cavities of alveoli

Solution: Functional **mammary glands** are exocrine, modified sweat glands in humans that lies over the pectoral muscles, which are also a **characteristic feature of mammalian females**. Also known as the breasts, these are paired structures that contain a variable amount of fatty glandular tissue. The glandular tissues of each breast are divided into **15-20 mammary lobes** of compound tubuloalveolar type, containing clusters of cells called **alveoli**. The cells of the alveoli secrete milk, which is stored in the **cavities (lumen) of alveoli**.



Q.7. The 'fimbriae' are involved in

A) collection of sperms

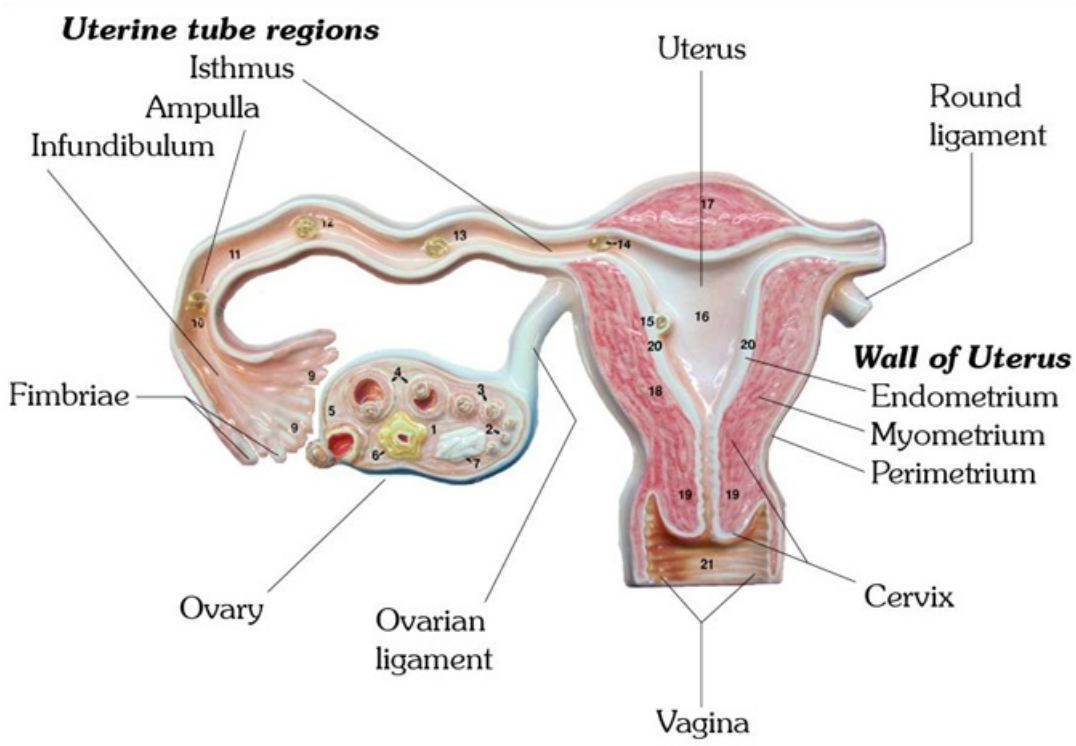
B) collection of ova

C) collection of zygote

D) collection of coelomic fluid

Answer: collection of ova

Solution: **Ovaries** are primary female sex organs which produce ovum, the female gamete and several, steroid ovarian hormones. The **fallopian tube** (oviducts) extends from the periphery of each ovary to the uterus; it is divided into three parts - infundibulum, ampulla and isthmus. The funnel-shaped part closer to the ovary, having finger-like projections called fimbriae, is called the infundibulum; it is connected to the uterus. Fimbriae help in the **collection of ova** after ovulation.



Q.8. Birth canal is formed by

A) Uterus + Vagina

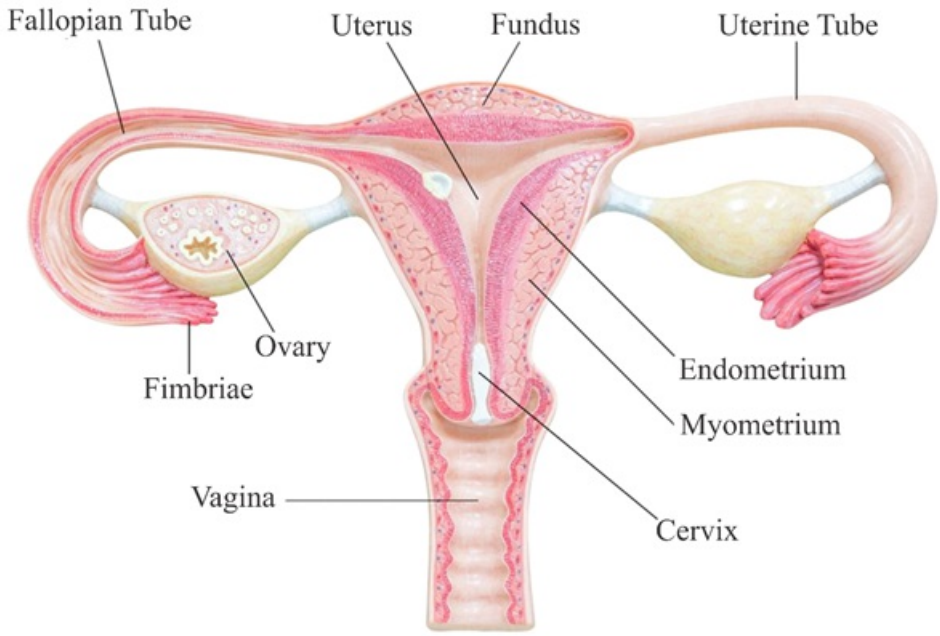
B) Vagina + Vestibule

C) Vestibule + Urethra

D) Cervical canal + Vagina

Answer: Cervical canal + Vagina

Solution: The **uterus**, also called the womb, has the shape of an inverted pear. It is supported by ligaments attached to the pelvic wall. The inside of the uterus is called the uterine cavity, which is formed of 3 layers of tissues (perimetrium, myometrium and endometrium). The lower end of the uterine cavity opens into the **vagina** through a narrow **cervix**. The cavity of the cervix is also called the cervical canal, which along with vagina forms the **birth canal**.



Q.9. Sertoli cells are regulated by the pituitary hormone known as

A) LH

B) FSH

C) GH

D) prolactin

Answer: FSH

Solution: The proper maturation of the spermatozoa requires two pituitary hormones - **follicle-stimulating hormone** (**FSH**) and **luteinizing hormone** (**LH**).
FSH (also called the gametokinetic or gametogenesis factor) stimulates testicular growth, along with the enhanced production of the androgen-binding protein by the **Sertoli cells** of the seminiferous tubules. This protein concentrates the testosterone in the local vicinity of the growing sperms, allowing proper development. Under the influence of such androgens, the Sertoli cells also secrete a polypeptide hormone called **inhibin** which interferes with spermatogenic activity and kinetics of sperm production, effectively regulating the process.
LH stimulates the production of testosterone from the **Leydig cells** (also known as **interstitial cells** of Leydig) of the seminiferous tubules.

Q.10. Which hormone is responsible for relaxing the ligaments of pelvic girdle?

A) Relaxin

B) Oxytocin

C) Progesterone

D) Prostaglandin

Answer: Relaxin

Solution: **Relaxin** is secreted from maternal ovary (corpus luteum) during the initial period of pregnancy. It is secreted in large quantity at the time of labor by placenta and mammary glands.
i. Helps labor by softening the cervix and loosening the ligaments of symphysis pubis, so that the dilatation of cervix occurs.
ii. Increases the number of receptors for oxytocin in the myometrium.
iii. Simultaneously suppresses the inhibitory action of progesterone on uterine contraction so that the uterus starts contracting.
iv. Facilitates the development of mammary glands.

Q.11. Sometimes the labour pain is less and uterine contractions have to be induced. What do you think the doctors inject to induce delivery?

A) Progesterone and estrogen hormones

B) Oxytocin

C) FSH and LH

D) Relaxin

Answer: Oxytocin

Solution: The uterus has oxytocin receptors which respond to oxytocin by initiating a contraction. Contractions start at the top of the uterus and 'wave' downwards. The cervix must be ready before it will respond to contractions by an opening. This is why induction usually involves preparation of the cervix with prostaglandins before starting a pitocin drip (oxytocin injection) to create contractions.

When the uterus contracts, the placental circulation is reduced (more so if the waters have broken), slightly decreasing the oxygen supply to the baby. This is why there are breaks in between the contractions– to allow babies to rebalance their oxygen levels before the next contraction.

Q.12. Which of the following is an incorrect statement?

A) External genitalia develops in the third month

B) Fetal movements are observed during the fifth month

C) Blastopore is found in gastrula and is the opening of blastocoel

D) Dentine of tooth is derived from mesoderm

Answer: Blastopore is found in gastrula and is the opening of blastocoel

Solution: Gastrulation is the process by which a blastula converts into gastrula. During gastrulation, a three-layered embryo made of ectoderm, mesoderm, and endoderm enclosing a new cavity called archenteron is formed. The lumen of the archenteron forms the future gut, which opens outside through the blastopore. In protostomes, the blastopore becomes the mouth and in deuterostomes, the anus.

Q.13. Which of the following is correct regarding the function of chorion?

A) It acts as hemopoietic tissue in early weeks of pregnancy

B) It forms the fetal part of placenta

C) It is derived entirely from inner cell mass

D) It keeps the embryo moist and secretes amniotic fluid

Answer: It forms the fetal part of placenta

Solution: The extra embryonic membranes/fetal membranes are yolk sac, amnion, chorion, and allantois.

Chorion in primates forms the placenta. This chorionic placenta protects the embryo and allows metabolic exchange between the fetus and the mother. Yolk sac in humans is vestigial and it acts as the site of blood cell formation till the 6^{th} week of gestation. Amnion acts as a cushion for the embryo and prevents the embryo from desiccation. Allantois serves as a urinary bladder and stores the crystals of uric acid. The "chorioallantoic membrane" acts as an extra-embryonic lung and supplies oxygen to the embryo.

Q.14. Which of the following is incorrect regarding cleavage divisions in early embryonic stages?

A) Increase in oxygen consumption

B) Increase in nuclear/cytoplasmic ratio

C) Progressive decease in cell size

D) Slow DNA replication, but rapid synthesis of cytoplasmic constituents

Answer: Slow DNA replication, but rapid synthesis of cytoplasmic constituents

Solution: Cleavage is the continuous division of cells in the early embryo after fertilization. The zygote undergoes a rapid cell division without the overall growth of blastomeres size. Cleavage produces a cluster of cells and the same size of the original zygote is retained. During cleavage, the nuclear-cytoplasmic ratio increases, there will be rapid DNA replication, short interphase with no or absence of an increase in the cytoplasmic constituents is observed.

Q.15. Signals from the fully developed foetus and placenta ultimately lead to parturition which requires the release of?

A) Estrogen from placenta

B) Oxytocin from foetal pituitary

C) Relaxin from placenta

D) Oxytocin from maternal pituitary

Answer: Oxytocin from maternal pituitary

Solution: Process of parturition is induced by both the nervous system and hormones secreted by the endocrine glands of the mother. The signals for childbirth (parturition) originate from the fully developed foetus and placenta which induce mild uterine contractions called foetal ejection reflex. This causes the quick release of oxytocin from the maternal posterior lobe of the pituitary gland, which induces labor pains.

Q.16. In human breast, which of the following finally opens at the surface of the nipples?

A) Mammary tubules

B) Mammary duct

C) Mammary ampulla

D) Lactiferous duct

Answer: Lactiferous duct

Solution: Mammary lobes are found in the glandular tissue of each breast. Each mammary lobe is divided into numerous alveoli. Alveoli is a group of cells having a lumen within. Alveolar cells secrete milk in the lumen of alveoli where it is temporarily stored. Alveoli open in mammary tubules which join to form a mammary duct. Many mammary ducts join and open in a dilated area known as mammary ampulla. Mammary ampulla narrows and continues as a lactiferous duct which opens at the surface of the nipples in the areolar part.

Q.17. The sperm and the egg make different contributions to the zygote. Which of the following statements about their contributions are true?
(i) Sperm contributes most of the mitochondria.
(ii) Egg contributes most of the cytoplasm.
(iii) Both sperm and egg contribute haploid nucleus.
(iv) Both sperm and egg contribute centrioles.

A) (i) and (ii)

B) (ii) and (iii)

C) (iii) and (iv)

D) (i), (ii), (iii) and (iv)

Answer: (ii) and (iii)

Solution: The sperm is composed of different parts, namely, the head, neck, middle piece, and tail. The head of the **sperm contains a haploid** elongated nucleus that carries DNA (genetic material). The anterior portion of the sperm head is covered by a cap-like structure called the acrosome. It is filled with digestive enzymes that help in the lysis of the egg membrane during penetration. On the other hand, the secondary oocyte, which was arrested at the metaphase stage during ovulation, completes the second meiotic division when the sperm enters the cytoplasm of the egg cell. This gives rise to a **haploid ovum** and a second polar body, which fuses with the sperm cell to produce a **diploid zygote**.

Since the secondary oocyte retains a bulk of the nutrient-rich cytoplasm of the primary oocyte, the ovum formed is larger compared to the sperm, and therefore, it **contributes most of the cytoplasm during fertilisation**. The sperm cell consists of very limited cytoplasm.

Due to its size, the **egg cell also contributes to most of the mitochondria** of the zygote. However, the **centrioles are contributed solely by the sperm cell**, as it consists of two types of centrioles in the neck region - proximal and distal.

Q.18. The number of ova produced by a female who gave birth to identical twins and another who gave birth to fraternal twins are, respectively,

A) 1,1

B) 2,2

C) 1,2

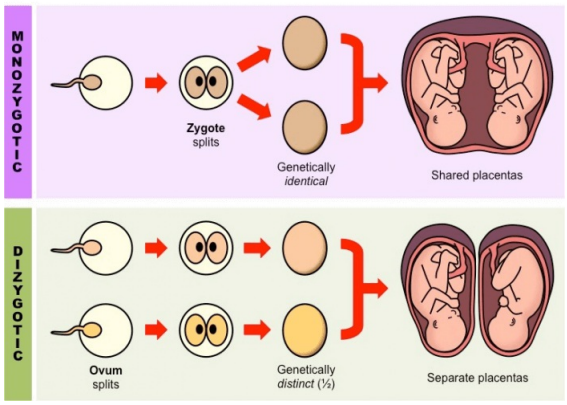
D) 2,1

Answer: 1,2

Solution: Twins are referred to as the couple of offspring who are produced from the same pregnancy.

Identical or monozygotic twins develop from the fertilization of a single egg to form a single zygote. This zygote divides into two embryos. Identical twins share a single placenta but may or may not share the same amniotic sac, depending on how early the single fertilized egg divides into two. They are genetically nearly identical, and they are always the same sex unless there has been a mutation during development. They also have the same genotype.

Fraternal (non-identical) or dizygotic twins develop from two fertilized eggs that are implanted at the same time in the uterus. They are a result of two eggs being fertilized by two different sperms, giving rise to two completely different individuals who happen to be born at the same time. They may look similar or different (in the case of boy-girl twins).



Q.19. The function of hyaluronidase is

A) To form cone of reception in egg.

B) To hydrolyse the hyaluronic acid of follicular cells.

C) That it is not produced in human sperm.

D) None of these

Answer: To hydrolyse the hyaluronic acid of follicular cells.

Solution: Fertilization is the process of fusion of a sperm and an ovum. For sperm to fuse with the egg, it has to penetrate through the eggs hard shell. Therefore the sperm goes through an acrosomal reaction. The acrosome is the anterior half of the sperm head. The release of various enzymes from the acrosome of sperm to dissolve the hard shell of an ovum is called an Acrosomal reaction.
Before the process of acrosomal reaction, glycoprotein present on sperm's outer surface bind with glycoprotein present on zona pellucida of an ovum. During an acrosomal reaction, sperm release hyaluronidase enzyme to penetrate corona radiata, which digest the hyaluronic acid present on follicular cells. Then the acrosin digest the cell membrane of the egg, and the content of the head of the sperm is emptied into the ovum.

Q.20. After fertilization, the corpus luteum increases in size and attains the diameter of

A) 10 to 20 mm

B) 30 to 50 mm

C) 20 to 30 mm

D) 40 to 50 mm

Answer: 20 to 30 mm

Solution: An ovarian follicle consists of an oocyte, surrounded by one or more layers of follicular cells, the granulosa cells, that are derived from the germinal epithelium lining the ovary. The oogonial cells start division and enter into prophase-I of the meiotic division, and get temporarily arrested at this stage called primary oocytes. Each primary oocyte gets surrounded by a layer of granulosa cells and then called a primary follicle. Numerous follicles degenerate from birth to puberty, called follicular atresia. Therefore, at puberty, only 60,000 to 80,000 primary follicles are left in each ovary. With the onset of puberty, a primary follicle begins to mature with each ovarian cycle. The follicular cells become cuboidal, divide by mitosis to form a stratified epithelium, the granulosa layer. So, the primary follicles get surrounded by more layers of granulosa cells and a new theca called secondary follicles. Granulosa cells rest on a basement membrane and the surrounding stromal cells form theca folliculi. The secondary follicle soon transforms into a tertiary follicle which is characterised by a fluid-filled cavity antrum, which appears between the granulosa cells. Initially, the antrum is crescent-shaped, but with time it greatly enlarged. The fluid of the antrum is liquor folliculi. As the follicles grow, the theca folliculi become organised into the inner layer of secretory cells, the theca interna and an outer layer of connective tissue cells containing fibroblast-like cells, the theca externa. The maturing oocytes adhere to the wall of the follicle through a pedicel/stalk, cumulus oophorus, formed by granulosa cells and remains suspended in liquor folliculi. Gradually, the primary oocyte within the tertiary follicle grows in size and completes its first meiotic division, and it is an unequal division resulting in the formation of a large haploid secondary oocyte and a tiny first polar body. The secondary oocyte retains the bulk of the nutrient-rich cytoplasm of the primary oocyte. The tertiary follicle transforms into the mature follicle, also known as the Graafian follicle.

The secondary oocyte forms a layer or new membrane of thick coat called zona pellucida, composed of glycoproteins. Later, the granulosa cells lying in close vicinity of the ovum and zona pellucida, become elongated to form the corona radiata. In the presence of LH hormone, the Graafian follicle now ruptures to release the secondary oocyte developing (ovum) from the ovary by the process called ovulation. After ovulation, the ruptured follicle left in the ovary is converted to a structure called corpus luteum, which secretes mainly progesterone. It forms the antrum which is a space in the follicle. It is lined by the granulosa cells. After fertilization, the corpus luteum increases in size and attains a diameter of nearly 2-3 cm.

Q.21. Menstrual flow occurs due to lack of

A) Progesterone

B) FSH

C) Oxytocin

D) Vasopressin

Answer: Progesterone

Solution: The menstrual cycle is a series of cyclical changes seen in the female reproductive system. It lasts for approximately 14-28 days.
On the 14th day of the menstrual cycle, the ovum is released from the Graafian follicle under the influence of LH. The ovum is then transported to the ampulla of the fallopian tube. Further, there is a possibility of the following two events:
1.The ovum is viable for a period of 24 hours. If the ovum comes in contact with a viable sperm during this period, the ovum will get fertilised. This will result into pregnancy. The remnant Graafian follicle will develop into corpus luteum which will start secreting progesterone. Progesterone is responsible for maintaining the endometrium. There will be changes in the uterine wall for implantation of the zygote and there will be no endometrial shedding. Thus, there will be no menstrual bleeding.
2.If fertilisation does not occur, the corpus luteum gets converted into corpus albicans and no progesterone secretion will occur. As a result, endometrial shedding occurs and menstrual bleeding is seen.
Hence, menstrual flow occurs due to a lack of progesterone.
The anterior pituitary secretes FSH. It is responsible for the growth and development of the ovarian follicles and proliferation of endometrium during the follicular phase. Lack of FSH is not accountable for menstrual flow.

Q.22. The correct flow of sperms includes

A) Seminiferous tubules - vasa efferentia - rete testis - epididymis - vas deferens.

B) Seminiferous tubules - rete testis - vasa efferentia - epididymis - vas deferens

C) Seminiferous tubules - seminal vesicles - vasa efferentia - epididymis - vas deferens.

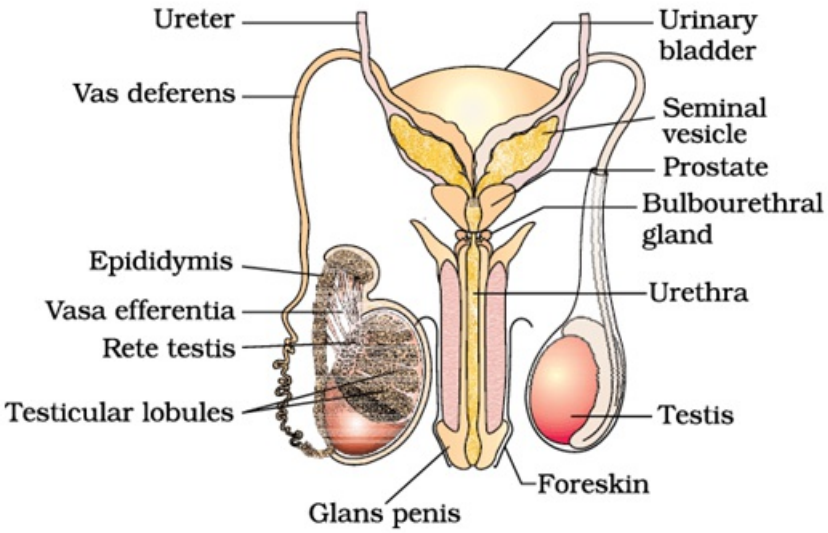
D) Seminal vesicles - vas deferens - vasa efferentia - epididymis- rete testis

Answer: Seminiferous tubules - rete testis - vasa efferentia - epididymis - vas deferens

Solution: **Spermatogenesis** is carried out in the **seminiferous tubules** of the testes, where the germ cells develop into male gametes with the help of Sertoli cells and androgens. These tubules are linked to the **vasa efferentia** via the **rete testis**. The vasa efferentia opens into another accessory duct called the **epididymis**, which opens into the **ductus deferens** (**vas deferens**), which ascends to the abdomen and loops over the urinary bladder. It receives a duct from the seminal vesicles, which opens into the urethra as the **ejaculatory duct**. This duct carries sperms outside the body through the process of ejaculation.

Thus, the correct flow of sperms includes:

Seminiferous tubules → Rete testis → Vasa efferentia → Epididymis → Vas deferens → Ejaculatory duct → Urethra → Penis



Q.23. Match the columns:

	Column I		Column II
(a)	Parturition	(p)	Attachment of blastocyst to endometrium
(b)	Gestation	(q)	Release of egg from Graafian follicle.
(c)	Ovulation	(r)	Delivery of baby from uterus
(d)	Implantation	(s)	Duration between conception and birth
(e)	Conception	(t)	Formation of zygote by fusion of egg and sperm
		(u)	Stoppage of ovulation and menstruation

A) $(a)-(q),\ (b)-(s),\ (c)-(p),\ (d)-(t),\ (e)-(r)$

B) $(a)-(s),\ (b)-(r),\ (c)-(p),\ (d)-(t),\ (e)-(q)$

C) $(a)-(r),\ (b)-(u),\ (c)-(q),\ (d)-(s),\ (e)-(t)$

D) $(a)-(r),\ (b)-(s),\ (c)-(q),\ (d)-(p),\ (e)-(t)$

Answer: $(a)-(r),\ (b)-(s),\ (c)-(q),\ (d)-(p),\ (e)-(t)$

Solution: Parturition is the process by which the completely formed baby is delivered out from the uterus, at the end of pregnancy. It involves vigorous contractions of uterus, which enables the expulsion of the foetus.

Gestation is the period between conception and birth of the child. It is also known as pregnancy. The human gestational period is 9 months.

Ovulation is the process by which the ovum i.e. egg is released out from the Graafian follicle. It usually occurs on the 14^{th} day of the menstrual cycle.

Implantation is the process by which the blastocyst gets attached to the endometrium. It usually occurs 7 days after fertilization.

Conception is the process by which a zygote is formed by the fusion of egg and sperm i.e. fertilization.

Q.24. Assertion (A): Zona pellucida disappears when the blastocyst reaches the uterus.

Reason (R): The role of zona pellucida is to check the implantation of the blastocyst at a proper site.

A) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.

B) Both Assertion and Reason are true, but Reason is NOT the correct explanation of Assertion.

C) Assertion is true, but Reason is false.

D) Assertion is false, but Reason is true.

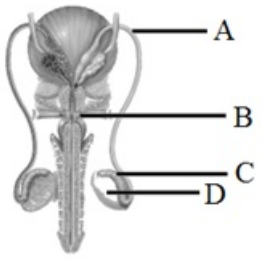
E) Both Assertion and Reason are false.

Answer: Both Assertion and Reason are true and Reason is the correct explanation of Assertion.

Solution: Zona pellucida is a thick transparent membrane made up of glycoproteins that surrounds the plasma membrane of the mammalian oocyte, which is produced by the Golgi apparatus of the oocyte.
Functions of zona pellucida:

- It develops the concept of species specification, i.e., the sperm will recognise the zona pellucida of the same species.
- It regulates the interaction of ovulated ovum and free-swimming sperm.
- It facilitates the acrosomal reaction.
- It prevents polyspermy.
- It checks the implantation blastocyst at a proper site by preventing the interaction between trophoblast and maternal tissue.

Q.25. Read the following statements about the given diagram carefully and state which of them are correct.



(i) A carries urine and sperms.
(ii) B secretes a fluid that helps in the lubrication of the penis.
(iii) D produces testosterone but not sperms.
(iv) C stores sperms.

A) (i) and (ii)

B) (ii) and (iii)

C) (ii) and (iv)

D) (i) and (iv)

Answer: (ii) and (iv)

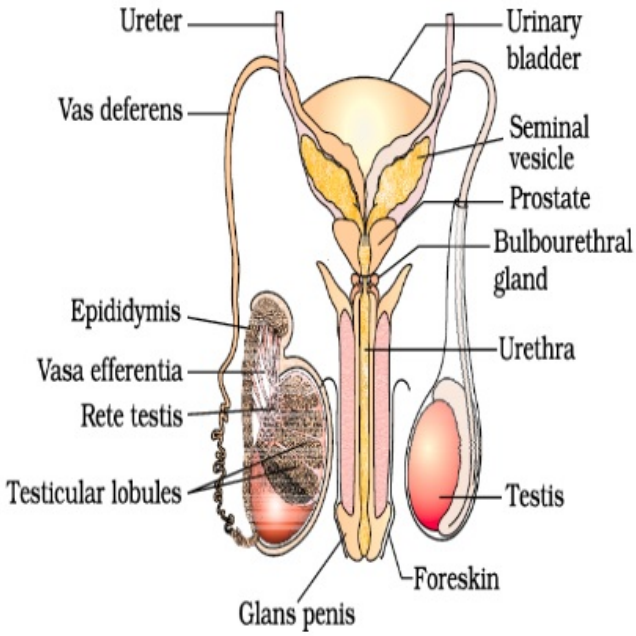
Solution: The given figure illustrates the male reproductive system of humans, and the labelled parts are as follows:

A - Vas deferens
B - Bulbourethral or Cowper's glands
C - Epididymis
D - Testis

The **testes** are the primary reproductive organs of the system, where **spermatogenesis** takes place. They produce androgens (commonly called 'male hormones) like **testosterone** which aid in both production and the development of sperms.

The **epididymis** and **vas deferens** are two of the male sex accessory ducts of the reproductive system. The seminiferous tubules of the testes are linked to the vasa efferentia via the rete testis. The vasa efferentia open into the epididymis, which **stores the sperms** and transport them from the testes to the vas deferens. The vas deferens further carries the sperms via the ejaculatory duct to the outside through the urethra.

Bulbourethral glands (also called the **Cowper's glands**) are either of the two pea-shaped glands within the male, located beneath the prostate at the start of the interior portion of the penis. They secrete an alkaline-mucus like fluid which helps in neutralizing the acidity of the vagina and **provides lubrication for the penis** during sexual intercourse.



Practice more on Human Reproduction