02 Reproduction in Lower and Higher Animals

Syllabus

2.0 Introduction

1. Define reproduction

Ans : Reproduction is defined as the biological process of formation of new life forms from pre-existing similar life.

INTEXT

Q.2 Can you recall?

i. Enlist the various life processes. Name the life process which is responsible for continuation of the human race.

Ans :

i. Circulation, respiration, nutrition, excretion, reproduction, control and coordination are the important life processes in organisms.

ii. Reproduction is the life process responsible for continuation of the human race.

ii. What are the common methods of reproduction in the unicellular organisms like *Euglena, Amoeba* and *Paramoecium*?

Ans : Binary fission is the asexual method of reproduction in the unicellular organisms like *Euglena, Amoeba* and *Paramoecium.*

iii. What type of asexual reproduction occurs in *Hydra*?

Ans : Budding type of asexual reproduction occurs in *Hydra*.

iv. What are the different methods of reproduction in animals?

Ans : Sexual and asexual are mainly two methods of reproduction in animals.

2.1 Asexual Reproduction in Animals

Q.3 Explain asexual reproduction in animals.

Ans :

i. It is a common method among lower animals.

ii. It does not involve meiosis nor gamete formation or gamete fusion.

iii. The formation of progeny is by a single parent only and does not involve both the sexes, so it is called as asexual reproduction.

iv. The progeny or daughter cells are genetically identical to the single parent and are also referred to as **clones**.

v. The lower animals reproduce asexually by gemmule formation, budding or fragmentation.

TEXTUAL

★Q.4 Explain the different methods of reproduction occuring in sponges.

Ans : Sponges reproduce by asexual as well as sexual methods.

i. **Asexual reproduction in sponges:**

a. Asexual reproduction in sponges is via gemmule formation

b. Gemmule is an internal bud formed only in sponges.

c. It has asexually produced mass or aggregation of dormant cells, the archaeocytes capable of developing into a new organism.

d. The archaeocytes get coated by a thick resistant layer of secretion by amoebocytes.

e. The gemmule is formed to overcome unfavourable conditions.
f. On return of favourable conditions of water and temperature, the gemmules hatch and develop into a new individual. e.g. *Spongilla*.

ii. **Sexual reproduction in Sponges:**
a. Poriferans reproducing by sexual methods are hermaphrodites and produce sperms and eggs at different times.
b. Female sponges capture the sperms disseminated into the water column.
c. The sperms are transported to eggs by archaeocytes, inside the female.
d. Zygote develops into ciliated lurvae after fertilization.
e. These larvae settle in the water column and develop into juvenile sponges.

TEXTUAL

★Q.5 Write a note on budding in *Hydra.*

Ans :

i. In Hydra asexual reproduction takes place through budding.
ii. It is a simple method of asexual reproduction normally occuring in favourable conditions.
iii. In *Hydra*, a small outgrowth is produced towards the basal end of the body.
iv. It develops as a bud which grows and forms tentacles and develops (get transformed) into a new individual.
v. The young *Hydra* gets detached from the parent and becomes an independent new organism.

Q.6 How does regeneration differ from asexual reproduction.

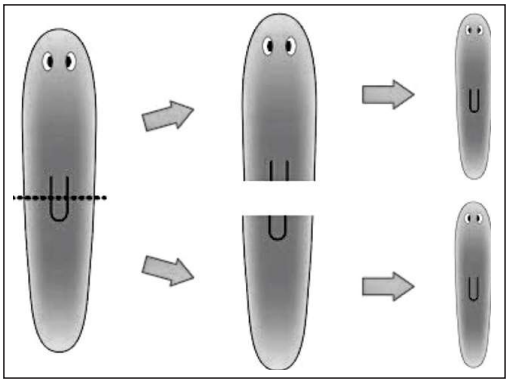
Ans :

i. Regeneration involves asexual processes, though it differs distinctly from reproduction
ii. By this process, the organism can only fundamentally repair or restore its lost or damaged part.
iii. For e.g. A damaged *Hydra* can regenerate its lost part. Similarly *Planaria* if wounded, its cells become active and regenerate lost part or organ back to its original state. *Planaria* although can reproduce asexually by fragmentation.

Q.7 Explain reproduction in *Planaria* by fragmentation.

Ans :

i. *Planaria* can reproduce asexually by fragmentation.
ii. It is seen in planarians that the anterior end exerts a pull on the posterior end resulting in a constriction in the middle part and spliting into two pieces.
iii. Each piece grows into a new *Planaria* i.e. two clones of original have been formed.



MULTIPLE CHOICE QUESTIONS

Entrance Set 1

1. Which type of reproduction is found in Hydra
(a) Polyembryony
(b) Sexual and asexual
(c) Parthenogenesis
(d) Encystment

2. Gemmule formation in sponges is helpful in
(a) Parthenogenesis
(b) Sexual reproduction
(c) Only dissemination
(d) Asexual reproduction

3. Drones in a colony of honey bees originate by
(a) Thelytoky
(b) Arrhenotoky
(c) Cyclic parthenogenesis
(d) Diploid parthenogenesis

4. Arrhenotoky is related to
(a) Parthenogenesis (b) Wax formation
(c) Both (a) and (b) (d) None of these

Try yourself

5. Asexual reproduction through formation of gemmule occurs in
   (a) Ascidian (b) *Hydra*
   (c) Planaria (d) *Spongilla*
6. Regeneration as a method of asexual reproduction is observed in
   (a) *Ascaris* (b) Planaria
   (c) Prawn (d) *Salmonella*
7. Asexual reproduction takes place in
   (a) Higher animals
   (b) Lower animals
   (c) Plants
   (d) All the above
8. As a result of binary fission number of individuals produced by one fission is
   (a) Two (b) Three
   (c) Four (d) Five

2.2 Sexual Reproduction in Animals

Q.7 Define sexual reproduction.

Ans : The process which involves the production of offspring by the formation and fusion of gametes is called as **sexual reproduction** or **amphimixis**.

Q.8 Write a note on phases in the lifetime of sexually reproducing animals.

Ans :

i. The earlier **juvenile phase** mainly represents physical growth phase starting from birth.
ii. The animals can not reproduce sexually in this phase.
iii. The later **reproductive maturity** phase is attained usually after physical growth is almost over.
iv. It involves growth and activity of the sex organs.
v. The animals can reproduce sexually in this phase.

Q.9 What are breeding patterns?

Ans :

i. The sexually reproducing animals show various breeding patterns.
ii. Some like the goat, sheep, and donkey are **seasonal breeders** i.e. these animals breed or mate only during a certain period of the year.
iii. Some are **continuous breeders** i.e. They can breed throughout the year eg: humans and apes.

Human Reproduction

Q.10 Enlist the steps involved in sexual reproduction in humans.

Ans : The process of secual reproduction involves various sequential steps such as gametogenesis, insemination, internal fertilization (i.e. fusion of male and female gametes), zygote formation and embryogenesis, gestation and parturition.

Q.11 Write a note on secondary sexual characters in males and females.

Ans :

i. In males, presence of beard, moustache, hair on the chest, muscular body, enlarged larynx (Adam's apple), are secondary sexual characters.
ii. In females these characters are the developed breast, broader pelvis and high pitched voice.

Q.12 Name the following.

i. Primary sex organs in males.

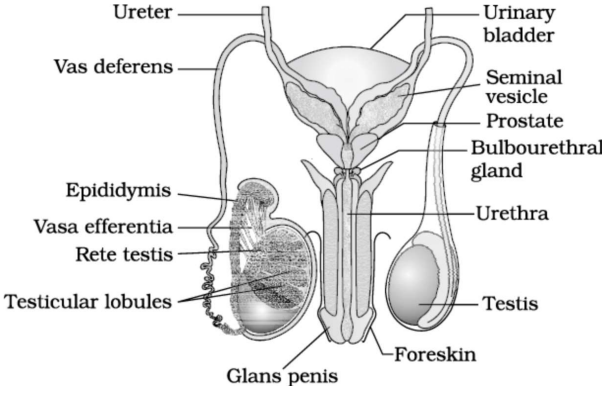
ii. Primary sex organs in females.

Ans : i. Testis
ii. Ovary

Male Reproductive System

Q.13 Explain the male reproductive system in detail.

Ans :



The male reproductive system consists of the following:

1. Primary male organ (Gonad) : Testis

2. Accessory ducts

3. Accessory glands

4. External genitalia : Scrotum and Penis

1 Primary sex organs : Testes

i. A pair of testes, mesodermal in origin, are formed in the lower abdominal cavity.

ii. They are located in a pouch called **scrotum**.

iii. During early foetal life, the testes develop in abdominal cavity and later they descend into the scrotal sac through a passage called **inguinal canal**.

iv. Each testis is oval in shape, 4 to 5 cm long, 2 to 3 cm wide and 3 cm thick.

v. The testis are suspended in the scrotum by the spermatic cord.

vi. Testosterone hormone stimulates the descent of testis and the fibro-muscular band called **gubernaculum** in the scrotum.

2. Accessory ducts:

i. **Rete testis:** The seminiterous tubules of the testis at the posterior surface form a network of tubules called rete testis.

ii. **Vasaefferentia:** The 12-20 fine tubules arising from rete testis are vasa-efferentia. They carry the sperms from the testis and open into the epididymis.

iii. **Epididymis:** It is a long and highly coiled tube which is differentiated into upper caput, middle corpus - and lower cauda epididymis. The sperms undergo maturation in epididymis.

iv. **Vas deferens:** It travels upto the abdominal cavity and loops over the ureter to open into the urethra. It joins the duct of seminal veside to form the ejaculatory duct.

v. **Ejaculatory duct:** The ejaculatory duct passes through the prostate gland and opens into the urethra.

vi. **Urethra:** The urethra provides a common passage for the urine and semen and hence is also called **urinogenital duct**. In males the urethra is long and extents through the penis. It opens to the outside by an opening called the urethral meatus or **urethral orifice**.

3. Accessory glands:

The male accessory glands are as follows:

i. **Seminal vesicles**

a. It is a pair of glands lying on the posterio side of urinary bladder.

b. It secretes an alkaline seminal fluid which contains fructose, fibrinogen and prostaglandins.

c. It contribues about 60% of the total volume of the semen.

d. Fructose provides energy for sperm movement while fibrinogen coagulates the semen into a bolus for quick propulsion in the vagina.

e. The prostaglandins stimulate reverse peristalsis in vagina and uterus aiding faster movement of sperms towards the egg in the female body.

ii. **Prostate gland**

a. It is a large and single gland made up of 20-30 lobes and is located underneath the urinary bladder.

b. It surrounds the urethra and releases a milky white and slightly acidic prostatic fluid into the urethra.

c. It forms about 30% of volume of semen.

d. It contains citric acid, acid phosphatase and various other enzymes.

e. The acid phosphatase protects the sperms from the acidic environment of vagina.

iii. **Cowper's gland / Bulbourethral gland:**

a. It is a small, pea sized and paired gland situated on either side of urethra.

b. These glands secrete an alkaline, viscous, mucous like fluid which acts as a lubricant during copulation.

c. **Semen:** It is the viscous, alkaline and milky fluid (pH 7.2 to 7.7) ejaculated by the male reproductive system. Normally 2.5 to 4.0 ml of semen is given out during a single ejaculation and it contains secretion of the epididymis and the accessory glands for nourishing (fructose), neutralizing acidity (Ca^{++}, bicarbonates), activation for movement (prostaglandins).

4. **External genitalia:**
It includes the penis and the scrotum.

i. **Penis:**
a. The penis is the male copulatory organ. It is cylindrical and muscular with three bundles of erectile tissue- a pair of postero-lateral tissue called **corpora cavernosa** and a median **corpus spongiousm**.
b. The swollen tip of the penis is called **glans penis**.
c. It is covered by a loose fold of skin called **foreskin** or **prepuce**.

ii. **Scrotum:**
a. It is a loose pouch of pigmented skin lying behind the penis and is divided into a right and left scrotal sac by a septum of tunica dartos made of smooth muscle fibres.
b. The foetal testes are guided into and retained in the scrotum by a short fibro muscular band called **gubernaculum**.
c. The testes remain suspended in scrotum by a spermatic chord.
d. Failure of testis to descend into scrotum is called **cryptorchidism**.
e. The failure also results in the sterility.
f. The cremaster and dartos muscles of scrotum help in drawing testes close or away from the body.
g. This in maintaining the temperature of the testis 2-3°C lower than the normal body temperature, necessary for spermatogenesis.

TEXTUAL

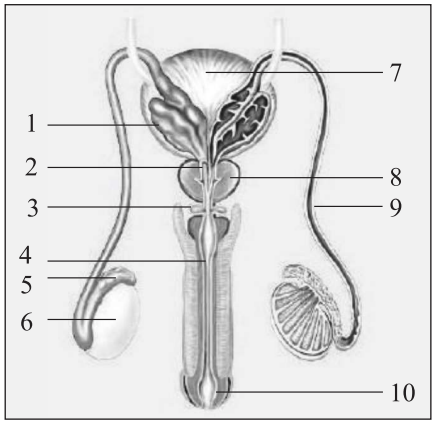
★Q.14 Explain the following parts of male reproduction system along with labelled diagram showing these parts - Testis, __ diferentia, epididymis, seminal veside, prostate flound and penis.

Ans : *Refer Q. 13*

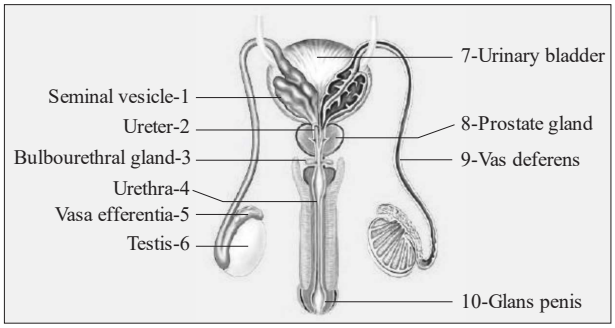
INTEXT

★Q.15 Can you recall?

Label the given male reproductive you have studied.



Ans :



★Q.16 Which is the function of male accessory glands.

Ans : *REFER Q.13.3*

★Q.17 Name the following

i. Endocrine glands involved in maintaining the sex characteristics of males
ii. Male and female gametes

Ans : i. TestIs (gonads)
ii. Male : Sperm, Female : Egg/Ovum

★Q.18 Outline the parth of sperm upto the urethra

Ans : Seminiferous tubules → Retetestis → Vasa efferentia → Epididymis → Vas deferens → Ejaculatory duct → Urethra

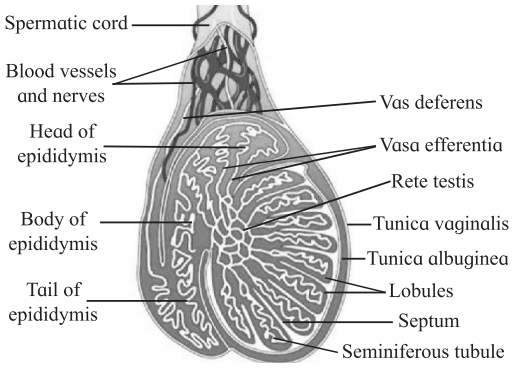
★Q.19 Which glands contribute fluids to the semen.

Ans : The seminal vesicle, prostate gland and cowper's gland contribute fluids to the semen.

TEXTUAL

★Q.20 Explain the histological structure of testis.

Ans :



i. The testis is externally covered by a collagenous connective tissue layer called **tunica albuginea**.

ii. Outer to it is an incomplete peritoneal covering called **tunica vaginalis**, and inner to it is **tunica vasculosa** a thin mebranous and vascular layer.

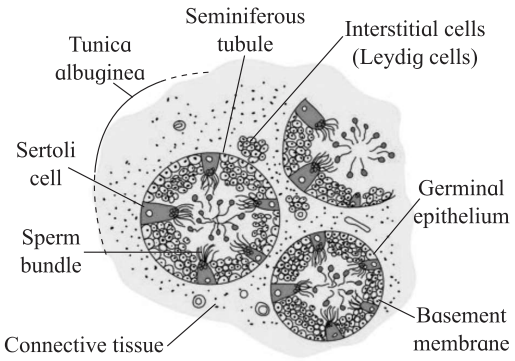
iii. Fibers from tunica albuginea divided each testis into about 200-300 testicular **lobules**.

iv. Each with 1-4 highly coiled **seminiferous tubules**.

v. Each seminiferous tubule is internally lined by cuboidal germinal epithelial cells (spermatogonia) and few large pyramidal cells called **Sertoti** or **sustentacular cells**.

vi. The germinal epithelial cells undergo gametogenesis to form the **spermatozoa**.

vii. Sertoli cells provide nutrition to the developing sperms.



T.S. of Testis

viii. Various stages of spermatogenesis can be seen in the seminiferous tubules.

ix. The inner most spermatogonial cell (2n), primary spermatocyte (2n), secondary spermatocyte (n), spermatids (n) and sperms (n).

x. The **Interstitial** or **Leydig's cells** lie in between the seminiferous tubules. They secrete the male hormone **androgen** or **testosterone**.

Q.21 Write a note on prostate cancer.

Ans :

i. Prostate cancer is cancer of the prostate gland.

ii. Men who are over 50 years of age and have a daily high consumption of fat, have an increased risk of prostate cancer.

Q.22 Write a note on uterus cancer.

Ans :

i. Most of the uterine cancers begin in the layer of cells that form the lining of endometrium of uterus.

ii. **Symptoms:** Abnormal bleeding between periods, vaginal bleeding after menopause, an abnormal watery, blood-tinged discharge from vagina, pelvic pain.

iii. **Detection:** It is diagnosed with Pap smear test, biopsy, Ultrasound.

iv. **Treatment:** Chemotherapy, radiation, surgical removal of uterus (hysterectomy).

Q.23 What is cryptorchidism?

Ans : The condition in which testis fail to descend into scrotum is called cryptorchidism.

INTEXT

Q.24 Activity

Find the symptoms of prostate cancer.

Ans : Early prostate cancer can have no symptoms, but people may experience

i. Pain in the bones.

ii. Urinary symptoms like frequent urination, urge to urinate and leaking, decreased urinary retention, or weak urinary system.

iii. Blood in the urine and semen.

iv. Erectile dysfunction and losing weight without trying.

INTEXT

Q.25 Internet my friend.

What is the role of prostaglanding?

Ans :

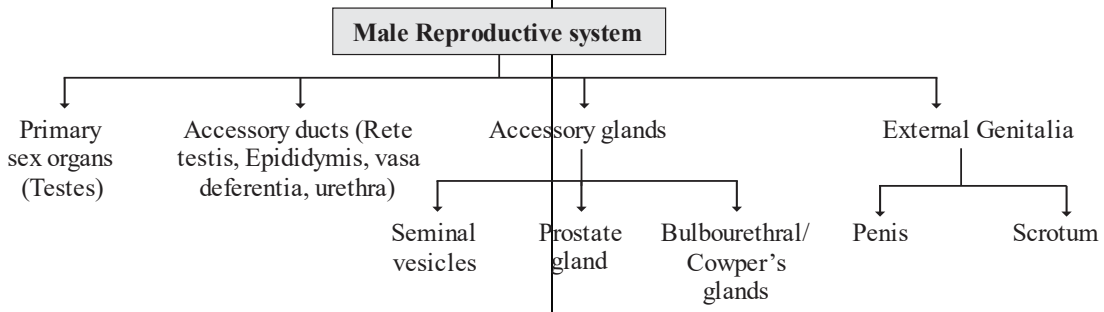
i. The prostaglandins are a group of lipids made

at sites of tissue damage or infection involved in dealing with injury and illness.

ii. They central processes such as inflammation, blood flow, the formation of blood clots and the induction of labour.

★Q.30 Prepare concept map on information of male reproductive system.

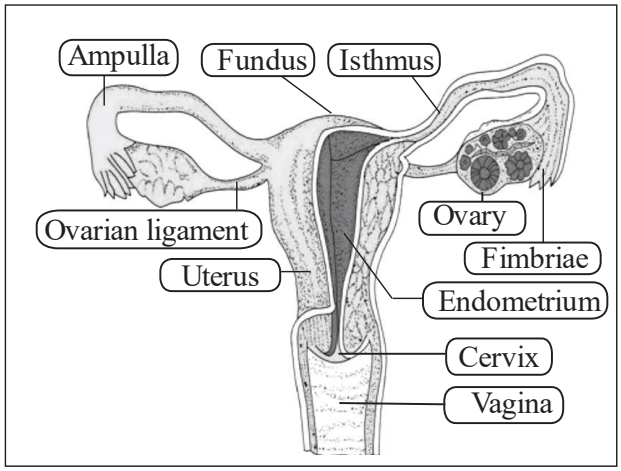
Ans :



Female Reproduction System

★Q.26 Describe female reproductive system of human

Ans :



The human female reproductive system consists of following parts:

1. A pair of ovaries
2. A pair of oviducts
3. Uterus
4. Vagina
5. External genitalia (vulva)
6. A pair of vestibular glands
7. A pair of mammary glands.

1. Ovary:

i. It is the primary female sex organ.

ii. Its main function is production of egg or ovum and the female reproductive hormones.

iii. It is solid, oval or almond shaped organ. It is 3.0 cm in length, 1.5 cm in breadth and 1.0 cm thick.

iv. It is located in the upper lateral part of the pelvis near the kidneys.

v. Each ovary is held in position by ligaments by attaching it to the uterus and the abdominal wall.

vi. The largest of these is the broad ligament formed by a fold of peritoneum.

vii. It holds the ovary, oviduct and the uterus to the dorsal body wall.

viii. The ovarian ligament attaches ovary to the uterus.

ix. The ovary produces five hormones viz, estrogen, progesteron, relaxin, activin and inhibin.

2. Oviduct/Fallopian tube/Uterine tube:

i. These are a pair of muscular ducts lying horizontally over the peritoneal cavity.

ii. The proximal part of the tube lies close to the ovary, and distally it opens into the uterus. Each tube is 10 to 12 cm in length.

iii. It is internally lined by ciliated epithelium.

iv. It can be divided into three regions:

a. **Infundibulum:** The proximal funnel like part with an opening called **ostium** surrounded by many finger like processes called **fimbriae** (of these at least one is long and connected to the ovary). The cilia and the movement of fimbrae help in driving the ovulated egg to the ostium.

b. **Ampulla:** It is the middle, long and straight part of the oviduct. Fertilization of the ovum takes place in this region.

c. **Isthmus/Cornua:** The distal narrow part of the duct opening into the uterus.

3. Uterus:

i. It is commonly also called the womb.

ii. It is a hollow, muscular, pear shaped organ, located above and behind the urinary bladder.

iii. It is about 7.5 cm long, 5 cm broad and 2.5 cm thick.

iv. The uterus can be divided into three regions:

a. **Fundus:** It is the upper dome shaped part. Normally implantation of the embryo occurs in the fundus.

b. **Body:** It is the broad part of the uterus which gradually tapers downwards.

c. **Cervix:** It is the narrow neck about 2.5 cm in length. It extends into the vagina. Its passage has two openings: an internal orifice towards the body, and an external orifice towards the vagina.

v. Internally the uterine wall can be distinguished into three layers i.e. outermost **perimetrium**, middle thick muscular **myometrium**, made up of thick layer of smooth muscles.

vi. Vigorous contractions of these muscles cause **labour**, during the **parturition** (child birth).

vii. The innermost layer called **endometrium** or mucosal membrane is made up of stratified epithelium.

viii. The thickness of this layer regularly undergoes changes in during the menstrual cycle.

ix. It is richly supplied with blood vessels and uterine glands. These provide nourishment to the developing foetus.

4. Vagina:

i. It is a tubular, female copulatory organ, 7 to 9 cm in length.

ii. It lies between the cervix and the vestibule.

iii. The vaginal wall has an inner mucosal lining, the middle muscular layer and an outer adventitia layer.

iv. The mucosal epithelium is stratified and non-keratinised and stores glycogen.

v. There are no glands but the cervical secretion of mucus is received in the vagina.

vi. The opening of the vagina into the vestibule is called **vaginal orifice**.

vii. This opening is covered partially by a fold of mucus mebrane called **hymen**.

viii. The vagina acts as a passage for menstrual flow as well as birth canal during parturition.

5. External genitalia:

i. The external genital organs of female include parts external to the vagina and are collectively called **'vulva'** (covering or wrapping), or **pudendum**. They include the following parts:

a. Vestibule - It is a median vertical depression of vulva enclosing the urethral and vaginal opening.

b. Labia minora - These are another pair of thin folds inner to the labia majora with which they merge posteriorly to form the fore chette while towards anterior end they converge into a hood like covering around the clitoris.

c. Clitoris - A small conical and sensitive projection lying at the antirior end of labia minora. It has a pair of erectile tissue - The corpora covernosa and is homologous to the penis.

d. Labia majora - These are a pair a fleshy folds of skin forming the boundary of vulva. They are homologous to the scrotum. The surround and protect the other parts of external genitalia and enclose the urethral and vaginal openings in the vestibule.

e. Mons pubis - It is a fleshy elevation above the labia majora. The Mons pubis and outer part of labia majora show pubic hair.

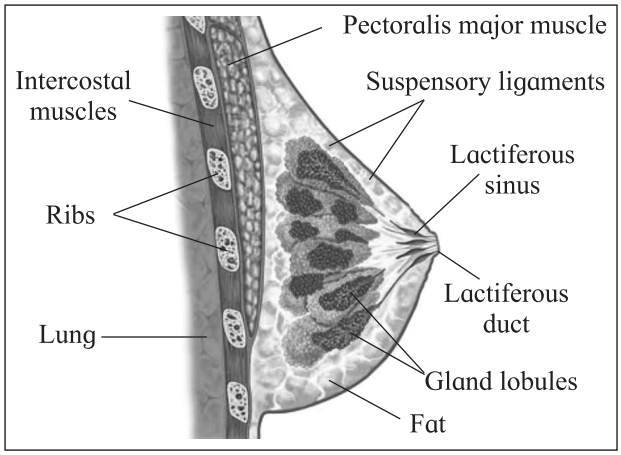
6. Accessary glands / Vestibular glands:

i. **Bartholin's glands:**

a. It is a pair of glands homologous to the Bulbourethral or Cowper's glands of the male.

b. They open into the vestibule and release a lubricating fluid.

ii. **Mammary glands:**



a. Accessory organs of female reproductive system for production and release of milk after parturition.
b. Development of the mammary gland occurs at puberty under the influence of estrogen and progesteron.
c. Lactotropic hormone (LTH) or prolactin helps in development of lactiferous tubules during pregnancy.
d. The mammary glands are a pair of rounded structures present in the subcutaneous tissue of the anterior thorax in the pectoral region (from 2nd to 6th rib). These are modified sweat glands.
e. Each mammary gland contains fatty connective tissue and numerous lactiferous ducts.
f. The glandular tissue of each breast is divided into 15-20 irregularly shaped mammary lobes, each with alveolar glands and lactiferous duct.
g. Alveolar glands secrete milk which is stored in the lumen of alveoli.
h. The alveoli open into mammary tubules. The tubules of each lobe join to form a mammary duct.
i. Many mammary ducts join to form a wider mammary ampulla, which is connected to lactiferous duct.
j. These converge towards the nipple located near the tip of the breast.
k. It is surrounded by a dark brown coloured and circular area of the skin called areola.

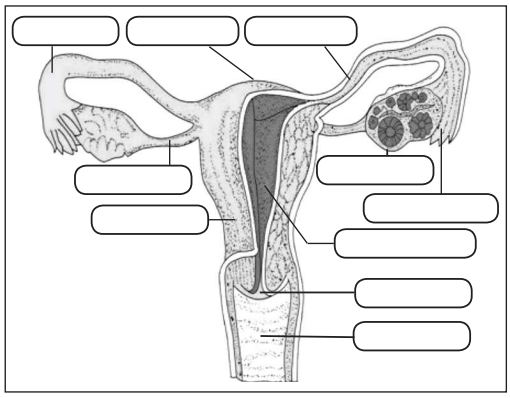
TEXTUAL

★Q.27 Enlist the external genital organs in female.

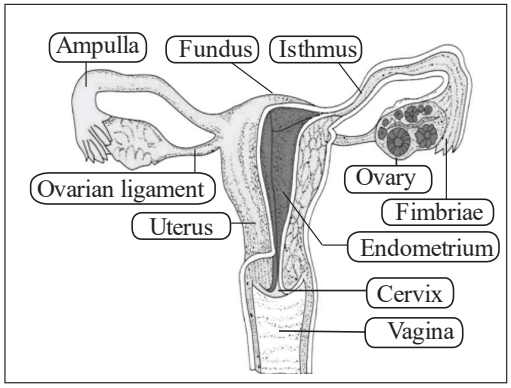
Ans : *Refer Q.26-5*

INTEXT

Q.28 Can you recall?
Give labels to given female reproductive system.



Ans :



TEXTUAL

★Q.29 Explain the histological structure of ovary in human.

Ans :

i. Each ovary is a compact structure differentiated into a central part called medulla and the outer part called cortex.
ii. The cortex is covered externally by a layer of germinal epithelium. The stroma or loose connective tissue of the medulla has blood vessels, lymph vessels, and nerve fibres.
iii. The outer cortex is more compact and granular. It shows large number of tiny masses of cells called ovarian follicies.
iv. These are collectively formed from the

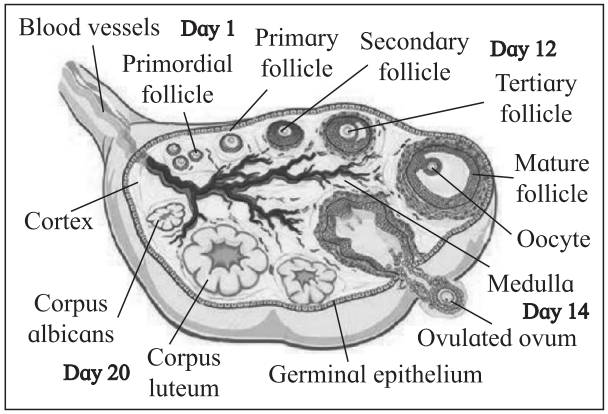
immature ova originating from cells of the dorsal endoderm of the yolk sac.

v. The cells migrate to the gonadal ridge during embryonic development and divide mitotically.

vi. Now these cells are called **oogonia**. As the oogonia continue to grow in size they are surrounded by a layer of granulosa cells and form the rudiments of the ovarian follicies.

vii. The process of oogenesis starts much before the birth of the female baby and by the end of twelve weeks the ovary is fully formed.

viii. It has more than two million **primordial follicles** in it.



ix. The cells of **germinal epithelium** give rise to groups of oogonia projecting into the cortex in the form of cords called **egg tubes** of **Pfluger**.

x. Each cord at its end has a round mass of oogonial cells called **egg nests**, from which the primordial ovarian follicles develop.

xi. Each primordial follicle has, at its center a large **primary oocyte** (2n) surrounded by a single layer of flat follicular cells.

xii. The primary oocyte starts with its meiotic division but gets arrested it at meiosis I.

xiii. Of the two million primordial follicles embedded in the foetal ovary only about one million remain at birth and only about 40,000 remain at the time of **puberty**.

xiv. These changes in the ovary are cyclic, occuring during each menstrual cycle and it involves maturation of the primordial follicles into primary, secondary and Graafian follicles.

xv. Each **primary follicle** has multilayered cuboidal follicular cells. The stroma cells add **theca** over the follicle. It now changes into a **secondary follicle**.

xvi. There is growth of the oocyte and the granulosa cells increase in number. They start producing the hormone estrogen.

xvii. The secondary follicle grows into the **Graafian follicle** by addition of more follicular cells. As this process of maturation of follicles take place, they begin to move towards the surface of ovary.

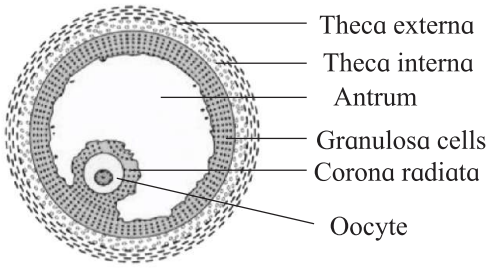
xviii. The Graafian follicle presses against the thin wall of the ovary giving it a blistered appearance.

xix The egg released from the Graafian follicle during **ovulation** and the remaining part of the follicle changes into a temporary endocrine gland called **corpus luteum**.

xx. If fertilization does not take place the corpus luteum degenerates into a white scar called **corpus albicans**.

Q.30 Describe the structure of Graafian follicle with a neat labelled diagram

Ans :



i. Graafian follicle is a mature ovarian follicle.

ii. An eccentric secondary oocyte is surrounded by a non-cellular layer of **zona pellucida** secreted by the vitelline membrane of oocyte.

iii. The outermost protective and fibrous covering is called **theca externa**.

iv. Inner to it is cellular **theca interna**. It produces the hormone estrogen.

v. Inner to the theca interna, the follicular cells form the **membrana granulosa**.

vi. From the membrana ganulosa the cells differentiate into **discus proligerus** and the **corona radiata** cells.

vii. **Cumulus oophorus** is the term used for the oocyte and surrounding granulosa cells.

viii. A fluid filled cavity called **antrum** lies between the oocyte and the **membrana granulosa**.

ix. It is filled with a fluid called **liquor folliculi**.

Q.31 Write a note on symptoms, detection and treatment for breast cancer.

Ans :

i. **Symptoms:**
   a. First symptom of breast cancer is a lump in breast or underarm.
   b. Lump is painless. Swelling of all or part of breast.
   c. Skin irritation, Breast or nipple pain, nipple retraction, Redness, scaliness or thickening of nipple or breast skin, discharge, etc.

ii. **Detection:** Mammogram (x-ray), ultrasound, MRI, Biopsy, Blood test.

iii. **Treatment:** Radiation therapy, chemotherapy lumpectomy, Mammoplasty.

Q.32 What is weaning:

Ans : Mother's milk is replaced gradually by solid food after sometime. This process is called weaning.

Q.33 Explain the following terms
i. Puberty ii. Menarche
iii. Menopause

Ans :

i. **Puberty** is the age at which the reproductive system becomes functional, sex organs begin to produce gametes and sex hormones.

ii. **Menarche** is the onset of menstrual cycle in females, usually occurs at the age of 10-14 years.

iii. **Menopause** is the termination of menstrual cycle. This normally happens at the age of 45-50 years.

MULTIPLE CHOICE QUESTIONS

Entrance Set 2

Set 2.2 Male Reproductive System

1. Select the correct sequence for transport of sperm cells in male reproductive system.
   (a) Testis → Epididymis → Vasa efferentia → Vas deferens → Ejacultory duct → Ingunial canal → Urethra → Urethral meatus
   (b) Testis → Epididymis → Vasa efferentia → Rete testis → Ingunial canal → Urethra
   (c) Seminiferous tubules → Vasa efferentia → Epididymis→ Vas deferens → Ejaculatory duct → Urethra → Urethral meatus
   (d) Seminiferous tubules → Vasa efferentia → Epididymis → Inguinal canal → Urethra

2. Which of the following depicts the correct pathway of transport of sperms?
   (a) Rete testis → Efferent ductules → Epididymis → Vas deferens
   (b) Rete testis → Epididymis → Efferent dutucles → Vas deferens
   (c) Rete testis → Vas deferens → Efferent dutucles → Epididymis
   (d) Efferent ductules → Rete tesis → Vas deferens → Epididymis

3. The main function of mammalian corpus luteum is to produce
   (a) Estrogen only
   (b) Progesterone
   (c) Human chorionic gonadotropin
   (d) Relaxin only.

4. The Leydig's cells as found in the human body are the secretory source of
   (a) Progesterone (b) Intestinal mucus
   (c) Glucagon (d) Androgens.

5. If for some reason, the vasa efferentia in the human reproductive system get blocked, the gametes will not be transported from
   (a) Testes to epididymis
   (b) Epididymis to vas deferens
   (c) Ovary to uterus
   (d) Vagina to uterus.

6. Sertoli cells are found in
   (a) Ovaries and secrete progesterone
   (b) Adrenal cortex and secrete adrenaline
   (c) Seminiferous tubules and provide nutrition to germ cells
   (d) Pancreas and secrete cholecystokinin.

7. Vasa efferentia are the ductules leading from
(a) Testicular lobules to rete testis
(b) Rete testis to vas deferens
(c) Vas deferens to epididymis
(d) Epididymis to urethra.

8. The part of Fallopian tube closet to the ovary is
(a) Isthmus (b) Infundibulum
(c) Cervix (d) Ampulla.

9. Cryptorchidism is the condition in man when
(a) There are two testis in each scrotum
(b) Testis do not descent into the scrotum
(c) Testis enlarge in the scrotum
(d) Testis degenerate in the scrotum

10. Seminiferous tubules develop central lumen after
(a) Birth
(b) Prepuberal time
(c) Puberty
(d) Old age

11. There are some special types of cells found in the seminiferous tubules known as sertoli cells. These are
(a) Germinal cells
(b) Reproductive cells
(c) Somatic cells
(d) Protective cells

12. Which cells in the testis secrete testosterone
(a) Interstitial cells or cells of Leydig
(b) Cells of the germinal epithelium
(c) Sertoli cells
(d) Secondary spermatocytes

13. The capsule enclosing testis of mammal is called as
(a) Tunica albuginea
(b) Tunica membrana
(c) Tunica vaginalis
(d) Tunica vesculosa

14. In man the two vasa deferentia open into
(a) Urinary bladder (b) Rectum
(c) Urethra (d) Penis

15. Testis and ovary lie
(a) Dorsal to kidney
(b) Ventral to kidney
(c) Lateral to kidney
(d) Diagonal to kidney

16. The seminal fluid coagulates on ejaculation due to
(a) Sodium contents from prostatic secretion
(b) Sodium contents from Cowper's glands
(c) Calcium and fibrinogen contents from prostatic secretion
(d) Secretions of epididymis

Try yourself

17. "Testes are extra-abdominal in position". Which of the following is most appropriate reason?
(a) Narrow pelvis in male
(b) Special protection for testis
(c) Prostate gland and seminal vesicles occupy maximum space
(d) 2.0 – 2.5°C lower than the normal body temperature.

18. Each testicular lobule contains _____ convoluted seminiferous tubules.
(a) 1 to 4 (b) 5 to 7
(c) 8 to 10 (d) 11 to 14

19. The nourishing cells in the Seminiferous tubules are
(a) Follicular cells (b) Leydig cells
(c) Sertoli cells (d) Spermatogonial cells

20. Which one of the following cells secretes a hormone?
(a) Cells of Leydig
(b) Cells of Sertoli
(c) Primary spermatocyte
(d) Secondary spermatocyte

21. Which of the following produces testosterone?
(a) Primordial germ cells
(b) Leydig cells
(c) Prostrate gland
(d) Bulbourethral gland

22. Which constituent of seminal fluid helps in coagulation of semen after ejaculation?
(a) Fibrin (b) Fibrinogen
(c) Fructose (d) Prostaglandins

23. Select the CORRECT match:

	Column A		Column B
i.	Surgical methods	a.	Corpus spongiosum
ii.	Prostate gland	b.	Membranous utethra
iii.	Ejaculatory duct	c.	Clitoris
iv.	Erectile tissues	d.	Fructose
		e.	Prostaglandins

(a) i - d (b) ii - e
(c) iii - a (d) iv - b

24. The spermatozoa NOT ejaculated are reabsorbed in the
(a) Ejaculatory duct (b) Urethra
(c) Vas efferens (d) Vas deferens

25. The shared terminal duct of the reproductive and urinary system
(a) Urethra (b) Ureter
(c) Vas deferens (d) Vasa efferentia

26. Which of the following depicts the CORRECT pathway of transport of sperms?
(a) Efferent ductules → Rete testis → Vas deferens → Epididymis
(b) Rete testis → Efferent ductules → Epididymis → Vas deferens
(c) Rete testis → Epididymis → Efferent ductules → Vas deferens
(b) Rete testis → Vas deferens → Efferent ductules → Epididymis

27. Study the following parts of the male reproductive system.
i. Rete testis
ii. Epidiydymis
iii. Urethra
iv. Seminiferous tubules
v. Vas deferens
vi. Ejaculatory duct
vii. Vasa efferentia
The correct sequence of parts through which sperms pass out is
(a) i, ii, iii, iv, v, vi, vii
(b) iv, i, vii, ii, v, vi, iii
(c) iv, i, vi, v, ii, vi, iii
(d) iv, vi, i, ii, v, vi, iii

28. Identify the CORRECT passage of spermatozoa in Human male reproductive System.
a. Vas deferens b. Epididymis
c. Urethra d. Vasa efferentia
e. Ejaculatory duct
f. Seminiferous tubules
(a) f → b → a → d → e → c
(b) b → d → f → c → a → c
(c) b → e → c → f → a → d
(d) f → d → b → a → e → c

29. Select th CORRECT sequence for transport of sperm cells in male reproductive system
(a) Seminiferous tubules → Vasa efferentia → Epididymis → Inguinal canal → Urethra
(b) Testis → Epididymis → Vasa efferentia → Vas deferens → Ejaculatory duct → Inguinal canal → Urethra → Urethral meatus
(c) Testis → Epididymis → Vasa efferentia → Rete testis → Inguinal canal → Urethra
(d) Seminiferous tubules → Rete testis → Vasa efferentia → Epididymis → Vas deferens → Ejaculatory duct → Urethra → Urethral meatus

30. The prostatic fluid forms about _____ of total volume of semen.
(a) 60% (b) 50%
(c) 40% (d) 30%

31. Major part by volume of semen is contributed by _____.
(a) Seminal vesicle
(b) Epididymis
(c) Cowper's gland
(d) Prostate gland

32. Identify the CORRECT match:

	Accessory glands		Functions
i.	Seminal vesicles	a.	Libricates vagina
ii.	Prostate gland	b.	Provide energy, coagulation of sperm
iii.	Cowper's gland	c.	Neutralizes acidity of vagina

(a) i - b, ii - c, iii - a
(b) i - c, ii - b, iii - a
(c) i - a, ii - c, iii - b
(d) i - c, ii - a, iii - b

Set 2.2 Female Reproductive System

1. Corpus luteum is the source of secretion of
   (a) Estrogen (b) Progesterone
   (c) Estradiole (d) LH
2. Ovulation in mammals is caused by
   (a) FSH and TSH (b) FSH and LH
   (c) FSH and LTH (d) LTH and LH
3. Stroma is a term applied to
   (a) Gall stone
   (b) Ovarian follicles
   (c) Connective tissue in which graffian follicles are embedded
   (d) Connective tissue surrounding the seminiferous tubules
4. What is the female counterpart of prostate gland in the male (man)
   (a) Bartholin's gland (b) Uterus
   (c) Clitoris (d) None of these
5. Corpus luteum in mammals is present in
   (a) Heart and initiates atrial contraction
   (b) Brain and connects the two cerebral hemispheres
   (c) Ovaries and produces progesterone
   (d) Skin and acts as a pain receptor
6. The structure formed after release of ova from graafian follicles and secretory in nature, is
   (a) Corpus callosum (b) Corpus luteum
   (c) Corpus albicans (d) Corpus stratum
7. When pregnancy does not occur, the life of corpus luteum is about
   (a) 10 days
   (b) 14 days
   (c) 28 days
   (d) Corpus luteum is not found
8. Human uterus is
   (a) Paired with well separated oviducts
   (b) Single large chamber with posterior part of oviduct fused to it anteriorly
   (c) Paired with partially fused oviducts
   (d) A single large chamber with completely fused oviducts
9. Cervix lies between
   (a) Oviduct and uterus
   (b) Uterus and vagina
   (c) Vagina and clitoris
   (d) Clitoris and labia
10. Vestibular glands secrete
    (a) Hormones (b) Enzymes
    (c) Mucus (d) Digestive juice
11. The first stage of graafian follicular growth involves
    (a) Addition of layers of granulosa cells
    (b) Moderate enlargement of the ovum
    (c) Formation of theca interna
    (d) Formation of theca externa
12. Ovulation can be detected by
    (a) Rise in basal body temperature
    (b) Fern pattern of the cervical mucosa
    (c) Urinary estradiol excretion
    (d) Plasma cholestrol estimation

Try yourself

13. Pick the ODD homologous pair out.
    (a) Bartholin's gland - Cowper's gland
    (b) Clitoris - Penis
    (c) Mons pubis - Glans penis
    (d) Labia majora - Scrotum
14. Oogonia arise from the endoderm of the ____.
    (a) Allantois (b) Chorion
    (c) Trophoblast (d) Yolk sac
15. In ovary, estrogen is secreted by _____.
    (a) Follicular cells
    (b) Corona radiata cells
    (c) Sertoli cells
    (d) Primary oocyte
16. The stroma of the ovary consists of nerves, blood vessels, muscle fibres and a type of protein called
    (a) Collagen (b) Albumin
    (c) Globulin (d) Fibrin
17. The nutritive medium for the ejaculated sperms is given by
    (a) Seminal fluid (b) Vaginal fluid
    (c) Uterine lining (d) Fallopian tube
18. In female mammals Bartholin's glands open into the
    (a) Vestibule and release a lubricating fluid in the vagina
    (b) Uterus and release a lubricating fluid during the birth of young ones
    (c) Urinary bladder and assists in release of urine

(d) Fallopian tubes and release a secretion which makes sperms motile

19. The mammalian follicle was first described by
(a) Von Baer
(b) Regner de Graaf
(c) Robert Brown
(d) Spallanzil

20. If after ovulation no pregnancy results, the corpus luteum
(a) Is maintained by the presence of progesterone
(b) Degenerates in a short time
(c) Becomes active and secretes lot of FSH and LH
(d) Produces lot of oxytocin and relaxin

21. Graafian follicle are characteristically found in the
(a) Thyroid of mammal
(b) Ovary of frog
(c) Testis of mammal
(d) Ovary of mammal

22. The layer of cells immediately surrounding the ovum but outside the zona pellucida is called
(a) Corona radiata
(b) Membrana granulosa
(c) Theca interna
(d) Germinal epithelium

23. The membrane investing the ovum just outside the membrana granulosa is
(a) Zona pellucida
(b) Theca interna
(c) Vitelline membrane
(d) Discus proligerous

2.3 Menstrual cycle (Ovarian cycle)

Q.34 What is Menstrual cycle

Ans :

i. Menstrual cycle is the characteristic feature of primates including human.

ii. It involves a series of cyclic changes in the ovary and the female reproductive tract, mainly in the uterus.

iii. These changes take place under the effect of gonadotropins and the ovarian hormones respectively.

iv. The cycles are repeated with a periodicity of approximately 28 days.

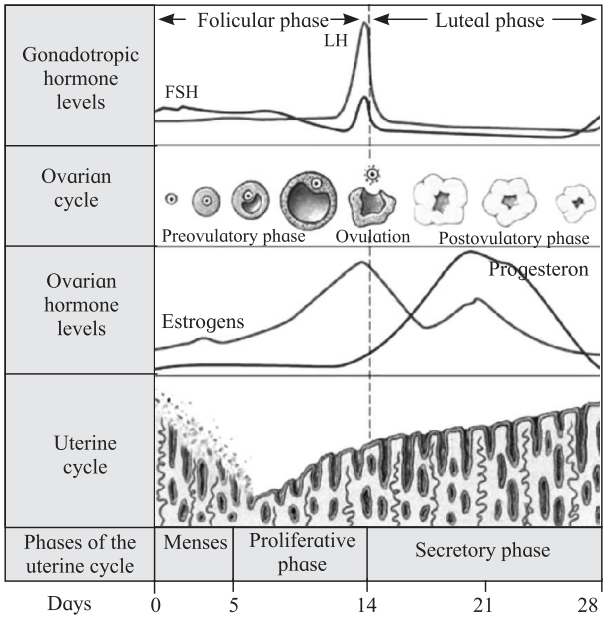
v. The middle of each cycle is characterised by the release of an egg.

vi. This egg in every cycle comes alternately from one of the two ovaries. The cycle is divided into four phases.

TEXTUAL

★Q.35 Describe the phases of mentrual cycle and their homonal cycle.

Ans :



The menstrual cycle is divided into four phases

i. Menstrual phase

ii. Proliferative phase / Follicular phase / Post menstrual phase

iii. Ovulatory phase

iv. Secretory phase / Luteal phase

i. Menstrual phase:

a. The begining of each cycle is taken as the first day where menses or loss of blood (45-100ml) takes place and it lasts for approximately five days (average 3-7 days).

Hormones and the menstrual cycle

b. Endometrium of uterus breaks down under the effect of prostaglandins released

due to decreased levels of progesteron and estrogen.

c. Due to this blood, tissue fluid, mucus, endometrial lining and the unfertilized oocyte is discharged through vagina.

d. The endometrial lining becomes very thin i.e. about 1 mm.

e. The menstrual discharge continues for an average of 5 days, however this blood does not clot due to presence of fibrinolysin.

f. Menstrual phase occurs when an ovulated egg does not get fertilized and it is thereby shed out along with the menstrum.

g. It is thus called 'funeral of unfertilized egg'.

h. During these five days, many primordial follicles develope into primary and few of them into secondary follicles under the effect of FSH.

ii. Proliferative phase / Follicular phase / Post menstrual phase

a. This phase is the duration between the end of menstruation and release of ovum (ovulation).

b. Duration of this phase is more variable than other phases. Generally, it extends from **5th to 13th day** of menstrual cycle.

c. A few (6 to 12) secondary follicles proceed to develop but usually one of them develops into a graafian follicle (mature follicle).

d. The other secondary follicles degenerate. This process of degeneration is called **atresia**.

e. Developing secondary follicles secrete the hormone estrogen. The stimulation for proliferation of new follicles is influenced by GnRH which stimulates release of FSH.

f. Endometrium begins to regenerate under the effect of gradually increasing quantity of estrogens. Regeneration also involves formation of endothelial cells, endometrial or uterine glands and network of blood vesels.

g. Thickness of endometrium reaches 3-5 mm.

iii. Ovulatory phase

a. It is the shortest phase of menstrual cycle.

b. It involves rupturing of the mature graafian follicle and release of ovum (secondary oocyte) into the pelvic cavity; usually on **14th day** of mestrual cycle.

c. Rapid secretion of LH by positive feedback mechanism causes the mature follicle to rupture.

d. Ovulation may be accompanied by mild or severe pains in lower abdomen.

iv. Secretory phase / Luteal phase

a. Duration of this phase is between the ovulation and beginning of the next menses. This phase is the longest phase. It lasts for 14 days; from **15th to 28th** day of the cycle.

b. After release of secondary oocyte, remaining tissue of graafian follicle transforms into corpus luteum under the effect of LH.

c. Corpus luteum begins to secrete progesteron and estrogens.

d. The ovulated egg may get fertilizedwithin 24 hours. However, in the absence of fertilization, corpus luteum can survive for only two weeks and then degenerate into a white scar called **corpus albicans**.

e. The corpus luteum releases progesteron, small amount of estrogens and inhibin.

f. Under the influence of these hormones, the endometrial glands grow, become coiled and start uterine secretions.

g. Endometrium becomes more vascularized and thickens up to 8-10 mm. Inhibin stops secretion of FSH.

h. These change changes are necessary for fertilization and subsequent implantation.

i. However, if the ovulated egg gets fertilized and the embryo is implanted, there is secretion of human chorionic gonadotropin (hCG), which extends the life of corpus luteum and stimulates it's secretary activity.

j. Presence of hCG in maternal blood and urine is an indicator of pregnancy. In absence of fertilization, next menstrual

cycle begins.

INTEXT QUESTION

Q.36 Internet my friend.

i. Enlist the examples of primates and non-primate animals.

Ans : Primates : Humans, apes, chimpanzees, gorillas, lemurs, baboons, tarsiers.
Non-primates: Birds, reptiles amphibians.

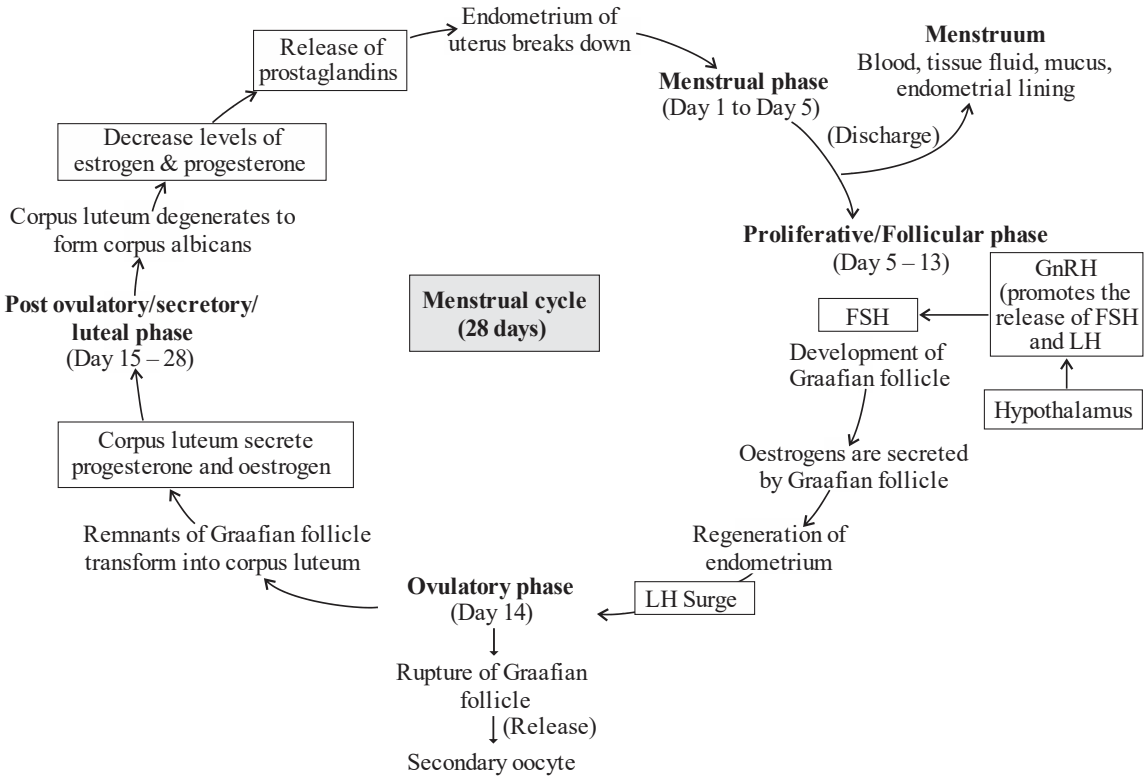
ii. Collect information about female reproductive cycles differentiating both primates and non-primates.

Ans :

	Reproductive cycle in primates	Reproductive cycle in non-primates
a.	It is known as menstrual cycle.	It is known as estrous cycle.
b.	The four phases are Proliferative, Ovulatory, Secretory and Menstrual phase.	The four phases are Proestrus, Estrus, Metestrus and Diestrus phase.
c.	Females are generally sexually receptive throughout the menstrual cycle.	Females are sexually receptive only during midestrus cycle.
d.	In case of no conception endometrium is shed off.	In case of no conception endometrial lining is reabsorbed during estrous cycle.
e.	Menstrual cycle results in cyclic changes in ovaries and uterus.	Apart from ovaries, vagina also represents cyclic changes.

Q.37 Activity
Prepare concept map of information of menstural cycle.

Ans :



Q.37 Use your brain power
Why menstruations is painful in some women?

Ans :

i. During periods there are contraction and relaxations in muscles of uterus which causes endometrial lining to shed.
ii. These contractions generally lead to discomfort in women, this condition is called as dysmenorrhea.
iii. Dysmenorrhea can be classified into primary and secondary dysmenorrhea.
iv. Primary dysmenorrhea occurs in women under the age of 30 having heavy periods. The causes could be stress, genetic factors etc.
v. Secondary dysmenorrhea is due to factors other than muscle contractions. Benign growth, fibroids, polyps, endometriosis, use of IUDs etc may result in pain in some women.

Q.39 Can you tell?
The names of primates who show the presence of menstrual cycle.

Ans : Humans, Orangutans, Gorillas and Chipanzees are the primates who show the presence of menstrual cycles.

Q.40 Write a note on hygiene practices during menstruation.

Ans :
i. Female should keep the pubic area clean.
ii. Change the sanitary napkin every 4-5 hours.
iii. Maintaining personal hygiene during menstruation is important to reduce the risk of infection.
iv. Used sanitary napkin should be disposed properly.
v. Using damp and dirty clothes or using a sanitary napkin for a longer time can act as a perfect environment for growth and multiplication of harmful bacteria and lead to infections.

MULTIPLE CHOICE QUESTIONS

Entrance Set 3

1. During menstrual cycle, the cyclic changes takes place in
   (a) Perimetrium (b) Endometrium
   (c) Corpus luteum (d) Myometrium
2. During ovulation, the ovary releases
   (a) Oogonia
   (b) Ootid
   (c) Primary oocyte
   (d) Secondary oocyte
3. No new follicles develop in the luteal phase of the menstrual cycle because:
   (a) Both FSH and LH levels are low in the luteal phase.
   (b) Follicles do not remain in the ovary after ovulation.
   (c) FSH levels are high in the luteal phase.
   (d) LH levels are high in the luteal phase.
4. In the menstrual cycle, the level of progesterone reaches its maximum in the _____.
   (a) secretory phase
   (b) proliferative phase
   (c) ovulatory phase
   (d) menstrual phase
5. The main function of mammalian corpus luteum is to produce
   (a) estrogen only
   (b) progesterone
   (c) human chorionic gonadotropin
   (d) relaxin only
6. No new follicles develop in the luteal phase of the menstrual cycle because:
   (a) Both FSH and LH levels are low in the luteal phase.
   (b) Follicles do not remain in the ovary after ovulation.
   (c) FSH levels are high in the luteal phase.
   (d) LH levels are high in the luteal phase.
7. Match the items given in column I with those in colum I and select the correct option given below.

	Column I		Column II
a.	Proliferative phase	(i)	Breakdown of endometrial lining
b.	Secretary phase	(ii)	Follicular phase
c.	Menstruation	(iii)	Luteal phase

   (a) i-b, ii-c, iii-a (b) i-a, ii-c, iii-b
   (c) i-c, ii-b, iii-a (d) i-c, ii-a, iii-b

Try yourself

8. Select the incorrect statement.

(a) LH and FSH decrease gradually during the follicular phase.
(b) LH triggers secretion of androgens from the Leydig cells.
(c) FSH stimulates the Sertoli cells which help in spermiogenesis.
(d) LH triggers ovulation in ovary.

9. Identify the correct statement on 'inhibin'.
(a) Is produced by granulosa cells in ovary and inhibits the secretion of LH
(b) Is produced by nurse cells in testes and inhibits the secretion of LH
(c) Inhibits the secretion of LH, FSH and prolactin
(d) Is produced by granulosa cells in ovary and inhinits the secretion of FSH.

10. Which of the following events is not associated with ovulation in human female?
(a) Release of secondary oocyte
(b) LH surge
(c) Decrease in estradiol
(d) Full development of Graafian follicle

11. Menstrual flow occurs due to lack of
(a) Oxytocin (b) vasopressin
(c) progestrone (d) FSH

12. The secretory phase in the human menstrual cycle is also called
(a) luteal phase and lasts for about 6 days
(b) follicular phase and lasts for about 6 days
(c) luteal phase and lasts for about 13 days
(d) follicular phase and lasts for about 13 days.

13. About which day in a normal human menstrual cycle does rapid secretion of LH (popularly called LH surge) normally occurs?
(a) 14^{th} day (b) 20^{th} day
(c) 5^{th} day (d) 11^{th} day

2.4 Gametogenesis

Q.41 Define gametogenesis

Ans : The gametogenesis is the process of formation of gametes in sexually reproducing animals.

Q.42 Describe the process of spermatogenesis and the changes during spermatogenesis.

Ans :

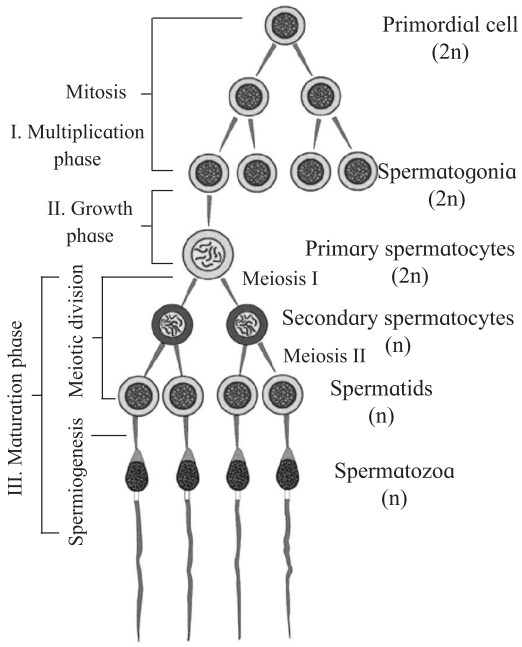
i. The process of formation of the male gamete (sperm) or spermatozoa from the germinal epithelium of testis is called spermatogenesis.

ii. At the onset of puberty, the hypothalamus begins secretion of gonadotropin releasing hormone (GnRH). It initiates the significant increase in the secretion of follicle stimulating homone (FSH) which induces spermatogenesis.

iii. Each seminiferous tubules is lined by a single layer of cuboidal epithelial cells called germinal epithelium.

iv. The cells of germinal epithelium undergo spermatogenesis to produce sperms.

v. Process of spermatogenesis involves three phases.



Spermatogenesis

vi. **Multiplication phase:**
a. The primordial germ cells (2n) of seminiferous tubules undergo repeated mitotic divisions to produce large number of spermatogonia (2n).
b. Each spermatogonium is diploid and with 46 chromosomes.

vii. **Growth phase:** Some of the spermatogonia stop dividing and grow in size to develop into primary spermatocytes (2n) due to accumulation of food.

viii. **Maturation phases:**
a. It involves meiotic or reduction division.

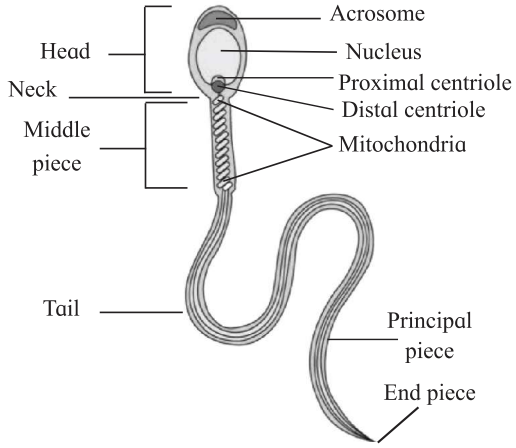
b. The spermatocyte undergoes the first phase of meiotic division (meiosis I) leading to formation of two haploid cells called secondary spermatocytes (n), which are with 23 chromosomes each.
c. The secondary spermatocyte undergoes second phase of meiotic division (meiosis II) to produce four haploid supermatids.
d. The spermatid is non-motile and non-functional. It gets transformed into a functional spermatozoa by the process called spermiogenesis.

ix. **Changes during Spermatogenesis:**
a. During this process of change, the spermatids remain held to each other and to the sertoli cells by cytoplasmic bridges.
b. The sperm heads remain attached to the sertoli cells and their tails hanging in the lumen of seminiferous tubule.
c. During spermiogenesis, length of spermatid increases.
d. Centrioles are rearranged as primary and distal centrioles. Mitochondria become spirally coiled and acrosome is formed from golgi complex.

Q.43 Write a brief note on structure of sperm.

Ans :

i. Sperm is the male gamete. It is a motile, microscopic elongaed cell.
ii. It is divisible into three parts-head, middle piece and tail.
iii. **Head:**
a. The sperm head is oval in shape and contains haploid nucleus.
b. Above nucleus, there is a cap like structure called **acrosome**. It is formed from the golgi body.
c. Acrosome contains hydrolytic enzymes; hyaluronidase and proteolytic enzymes like zona lysins and corona penetrating enzymes.
iv. **Neck :** It is a very short region having two centrioles i.e. proximal centriole and distal centriole.
v. **Middle piece:**
a. It has an axial filament surrounded by 10-14 spiral turns of mitochondria (nebenkern).
b. It produces energy necessary for the movement of sperm.
vi. **Tail:**
a. It is a long, slender and tapering part containing cytoplasm and fine thread-axial filament.
b. The axial filament arises from the distal centriole and travels through out the length of tail.
c. It is partly surrounded by plasma membrane (main piece). The part without plasma membrane is called end piece.



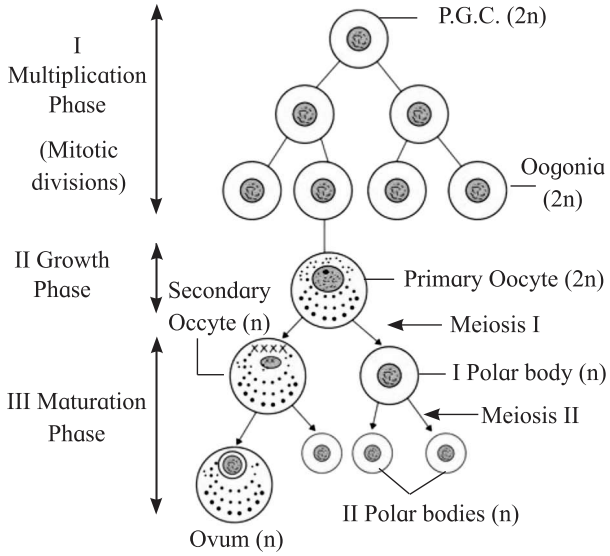
Q.44 Describe the process of oogenesis in details.

Ans :

i. It is process of formation of the haploid female gamete i.e. egg or ovum from the diploid germinal epithelium.
ii. It involves the process of meiosis (and mitosis).
iii. Like spermatogenesis, oogenesis process can be divided into three stages:
a. Multiplication phase
b. Growth phase
c. Maturation phase
iv. **Multiplication phase:**
a. In this stage, the primary germinal cells PGCs (2n) of ovary undergo repeated mitotic division to form millions of gamete mother cells or oogonial cells (2n).
b. This process is completed in the embryonic stage of human females.

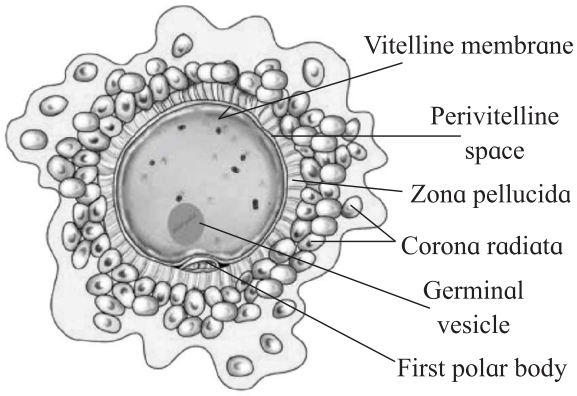
v. **Growth phase:**
   a. Some of the oogonia stop division and begin to increase in size and form the primary oocytes (2n)
   b. Cellular organelles like ER, golgi apparatus and mitochondria increase in number.

vi. **Maturation phase:**
   a. Oogenesis take place in the ovaries. The process is initiated prior to birth of the female baby.
   b. The primary oocytes (2n) enter the maturation phase which includes meiotic division (Meiosis I and Meiosis II).
   c. The diploid primary oocytes undergo meiosis I (reduction division) to form 2 haploid daughter cells. This division is peculiar in females as both the daughter cells are with haploid number of chromosomes i.e. 23 chromosomes.
   d. But due to unequall division of cytoplasm, of the 2 daughter cells produced, one is a large cell called secondary oocyte (n) and another is a small cell called 1st polar body (n).
   e. Normally the 1st polar body does not enter meiosis II.
   f. The secondary oocyte (n) proceeds meiosis II, only upto metaphase II. It's division is further stopped or arrested at this stage.
   g. The secondary oocyte is shed from the graafian follicle and ovary.
   h. The restart and completion of meiosis II will happen only with entry of the sperm.
   i. This last phase is usually completed in the ampulla of the fallopian tube at the time of fertilization.
   j. In this division also, the two unequal daughter cells are formed-the large cell is ovum (n) and the small cell is 2nd polar body (n).
   k. The ovum (n) so formed functions as the female gamete and is ready for fertilization.
   l. If the secondary oocyte does not receive the sperm/spermatozoa, it is shed on along with menstrum.



Q.45 Describe the structure of secondary oocyte.

Ans :



Unfertilized egg/Ovum

i. In human unfertilized egg when ovulated i.e. released from the ovary is actually the secondary oocyte.
ii. It is non-cleidoic (without shell) and microlecithal (yolk is present in very small quantity.
iii. It is approximately 0.1 mm (100 microns) in size. It is rounded, nonmotile and haploid female gamete.
iv. The nucleus of the egg appears large and is called **germinal vesicle**.
v. Typical nucleus or pronucleus is formed at the time of fertilization.
vi. The cytoplasm of egg is also called **ooplasm**. It is devoid of centrioles.

vii. The egg is surrrounded by various coverings. The egg membrane is called vitelline membrane.

viii. It secretes a non-cellular glycoproteinous membrane, **zona pellucida** on its outside.

ix. Adhering to the outer surface of zona pellucida are several radially elongated cells forming the **corona radiata**.

x. These cells are derived from the innermost layer of granulosa cells.

xi. They are firmly held to the zona pellucida and to each other by hyaluronic acid (mucopolysaccharide).

xii. Between the vitelline membrane and the zona pellucida is a fluid filled perivitelline space. The first polar body lies in this space.

xiii. The egg shows polarity. The side having germinal vesicle and first polar body is called **animal pole** while the side opposite to it is called **vegetal pole**.

Q.47 Activity

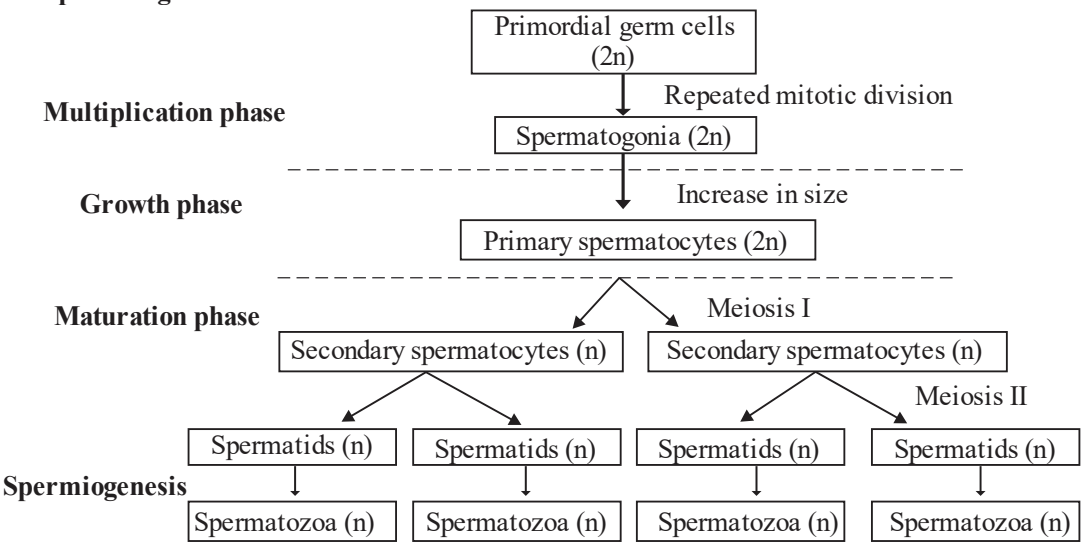
Prepare concept maps on information of gametogenesis.

i. Spermatogenesis

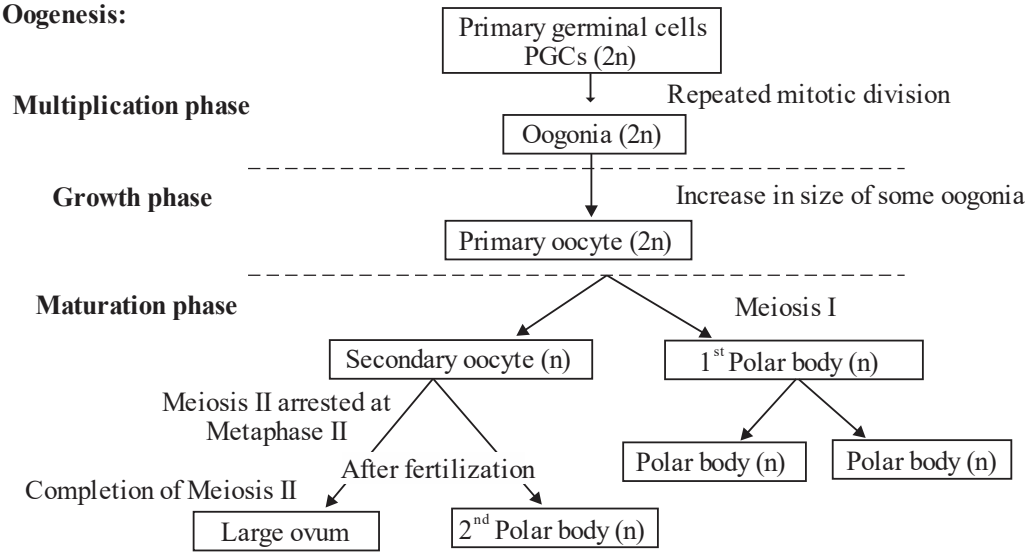
ii. Oogenesis

Ans :

i. Spermatogenesis:



ii. Oogenesis:



Q.46 Activity

Prepare a chart of comparison betweeen spermatogenesis and oogenesis.

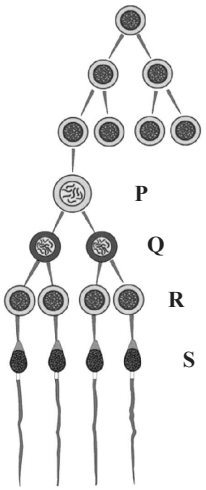
Ans :

	Spermatogenesis	Oogenesis
i.	Spermatogenesis is the process of formation of the male gamete (sperm) or spermatozoa from the germinal epithelium of testis	Oogenesis is the process of formation of haploid female gamete i.e. egg or ovum from the diploid germinal epithelium.
ii.	It occurs in testes.	It occurs in ovaries.
iii.	It starts and completes within the testes.	It starts inside ovary but is generally completed outside ovary in oviduct.
iv.	It begins with primary spermatocytes	It begins with primary oocyte.
v.	Upto the formation of spermatids, the cells often remain interconnected.	Oogonia are separated and surrounded by follicle cells.
vi.	It begins at puberty.	It begins during foetal development.
vii.	A spermatogonium forms four spermatozoa sperms.	An oogonium forms one ovum and 2-3 polar bodies.
viii.	Sperms are motile, adapted to swim.	Eggs are non-motile.
ix.	Sperms are produced in large number.	Eggs are produced in lesser numbers.

MULTIPLE CHOICE QUESTIONS

Entrance Set 4

1. Indicate the CORRECT sequence during spermatogenesis.
   (a) Spermatozoa → spermatogonia → spermatid → spermatocyte
   (b) Spermatogonia → spermatocyte → spermatid → spermatozoa
   (c) Spermatid → spermatocyte → spermatozoa → spermatogonia
   (d) Spermatocyte → spermatozoa → spermatid → spermatogonia
2. Identify the cells that represent P, Q, R and S in the given schematic representation of spermatogenesis.



   (a) P - Spermatozoa
       Q - Spermatids
       R - Secondary spermatocyte
       S - Primary spermatocyte
   (b) P - Primary spermatocyte
       Q - Secondary spermatocyte
       R - Spermatids
       S - Spermatozoa
   (c) P - Secondary spermatocyte
       Q - Spermatids
       P - Spermatozoa
       S - Primary spermatocyte
   (d) P - Secondary spermatocyte
       Q - Primary spermatocyte
       R - Spermatozoa
       S - Spermatids
3. Which of the following cells during gametogenesis is normally diploid?
   (a) Primary polar body
   (b) Spermatid
   (c) Spermatogonia
   (d) Secondary polar body
4. In spermatogenesis at the end of the first meiotic division _____ are formed.
   (a) Spermatids
   (b) Primary spermatocyte
   (c) Secondary spermatocyte

(d) Spermatogonia

5. In which of the following cells first meiotic division is observed?
   (a) Spermatogonia
   (b) Primary spermatocytes
   (c) Secondary spermatocytes
   (d) Spermatids
6. The process of conversion of non-motile sprmatids into motile spermatozoa is called
   (a) spermiogenesis
   (b) oogenesis
   (c) sporogenesis
   (d) spermatogenesis
7. Spermiogenesis involves all of the following, EXCEPT
   (a) Formation of mitochondrial sheath
   (b) Formation of proximal and distal centrioles
   (c) Formation of acrosomes
   (d) Shortening of sperm
8. Where does the process of oogenesis get completed in human?
   (a) In oviduct
   (b) In ovarian follicle
   (c) In uterus
   (d) In the cervix of the uterus

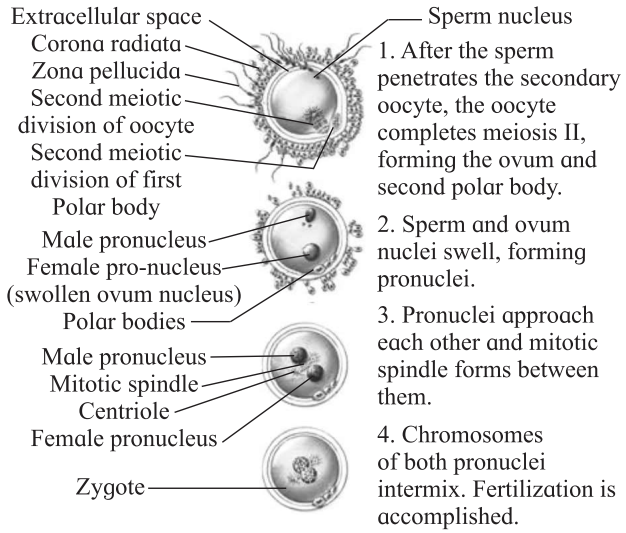
Try yourself

9. The termination of process of oogenesis is indicated by formation of _____.
   (a) secondary oocyte
   (b) first polar body
   (c) second polar body
   (d) perivitelline space
10. An axial filament in the tail of sperm is modified _____.
   (a) Distal centriole
   (b) Endoplasmic reticulum
   (c) Golgi complex
   (d) Proximal centriole
11. The difference between spermiogenesis and spermiation is
   (a) in spermiogenesis spermatids are formed, while in spermiation speratozoa are formed
   (b) in spermiogenesis spermatozoa are formed, while in spermiation spermatids are formed
   (c) in spermiogenesis spermatozoa from Sertoli cells are released into the cavity of seminiferous tubules, while in spermiation spermatozoa are formed
   (d) in spermiogenesis spermatozoa are formed, while in spermiation spermatozoa are released from Sertoli cells into the cavity of seminiferous tubules.
12. Which of the following cells during gametogenesis is normally diploid?
   (a) Spermatogonia
   (b) Secondary polar body
   (c) Primary polar body
   (d) Spermatid
13. What is the correct sequence of sperm formation?
   (a) Spermatogonia, spermatozoa, spermatocytes, spermatids
   (b) Spermatogonia, spermatocytes, spermatids, spermatozoa
   (c) Spermatids, spermatocytes, spermatogonia, spermatozoa
   (d) Spermatogonia, spermatocytes, spermatozoa
14. Which one of the following statements is false in respect of viability of mammalian sperm?
   (a) Sperm is viable for only up to 24 hours.
   (b) Survival of sperm depends on the pH of the medium and is more active in alkaline medium.
   (c) Viability of sperm is determined by its motility.
   (d) Sperms must be concentrated in a thick suspension.
15. Which one of the following statements about human sperm is correct?
   (a) Acrosome has a conical pointed structure used for piercing and penetrating the egg, resulting in fertilisation.
   (b) The sperm lysins in the acrosome dissolve the egg envelope facilitating fertilisation.
   (c) Acrosome serves as a sensory structure leading the sperm towards the ovum.
   (d) Acrosome serves no particular function.

2.5 Fertilization/Syngamy

★Q.48 Describe the process of fertilization

Ans :



Process of Fertilization

i. Fertilization is the process which involves fusion of the haploid male and female gametes resulting in the formation of a diploid zygote (2n).

ii. The process of fertilization is internal and it usually takes place in the ampulla of the fallopian/uterine tube.

iii. The fertilized egg or zygote will develop into an embryo and this process occurs within the uterus.

iv. The mechanism of fertilization is as follows:

1. **Movement of sperm towards egg:**
   a. It involves capacitation of sperms reaching the vagina.
   b. Here as many as 50% are demotilised/ broken/destroyed. Remaining sperms undergo capacitation.
   c. This process requires 5-6 hours.
   d. Acrosome membrane becomes thin, Ca^{++} enters the sperm and their tails begin to show rapid whiplash movements.
   e. As a result of capacitation, sperms become extra active and begin to start moving upwards from vagina to uterus and to the oviducts.
   f. The prostaglandins activate the sperms. The vestibular secretions of the female also enhance sperms motility.
   g. The sperms swim at an average speed of 1.5 to 3.0 mm/min.
   h. Sperms reach upto the ampulla as a result of their own swimming and partly by contraction of uterus and and fallopian tubes stimulated by oxytocin of female.
   i. After capacitation the sperms may reach ampulla within 5 minutes.
   j. Sperms can remain viable for 24-48 hours (Ovum for about 24 hours).

2. **Entry of sperm into the egg:**
   a. Out of 200 to 400 million sperms, only few hundred manage to reach the ampulla. Though many sperms reach the ampulla but only a single sperm fertilizes the ovum
   b. A sperm after reaching the egg/ovum comes to lie against it. Its acrosome releases lysins : hyaluronidase and corona penetrating enzymes.
   c. They separate and dissolve the cells of corona radiata, so the sperm head passes through the zona pellucida of egg.
   d. The zona pellucida has fertilizin receptor proteins (ZP3, ZP2).
   e. The fertilizin binds to specific acid protein- antifertilizin of sperm. It brings about attraction of sperms to the egg to enhance fertilization.
   f. **Acrosome reaction:** As the sperm head touches the zona pellucida in the animal pole region, its acrosome covering ruptures to release lytic enzymes, acrosin or zona lysin. They act on the zona pellucida at the point of contact.
   g. Thiscauses egg reaction - A small fertilization cone/cone of reception is formed on the egg membrane.
   h. The sperm head comes in contact with this cone. It results in production of a weak wave of depolarisation.
   i. Plasma membrane of the both cells dissolve at the point of contact.
   j. The sperm nucleus and the centrioles enter the egg, while other parts remain outside.

k. As soon as the sperm head touches the vitelline membrane, a cortical reaction gets activated changing the vitelline membrane into a fertilization membrane by deactivating the sperm receptors of zona pellucida.

l. A distinct perivitelline space is created around the fertilization membrane. This prevents any further entry of other sperms into the egg i.e. polyspermy is avoided.

3. **Activation of ovum:**

a. The ovum before fertilization was at metaphase II stage.

b. With a contact of sperm head to the vitelline membrane of egg, it gets activated to resume and complete its meiosis II. With this it gives out the second solar body.

c. The germinal vesicle organises into female pronucleus. At this stage, it is the true ovum or egg.

d. **Fusion of egg and sperm:** The coverings of male and female pronuclei degenerate allowing the chromosomal pairing.

e. This results in the formation of **synkaryon** by the process called **syngamy** or **karyogamy**.

f. The zygote is thus formed.

g. The proximal centriole received from the sperm helps in formation of the synkaryon spindle and cleavage of cell into two blastomeres.

TEXTUAL

★Q.49 What is capacitation? Give its importance.

Ans :

i. This process requires 5-6 hours.

ii. Acrosome membrane becomes thin, Ca^{++} enters the sperm and their tails begin to show rapid whiplash movements.

iii. As a result of capacitation, sperms become extra active and begin to start moving upwards from vagina to uterus and to the oviducts.

iv. The prostaglandins activate the sperms. The vestibular secretions of the female also enhance sperms motility.

v. The sperms swim at an average speed of 1.5 to 3.0 mm/min.

vi. Sperms reach upto the ampulla as a result of their own swimming and partly by contraction of uterus and and fallopian tubes stimulated by oxytocin of female.

vii. After capacitation the sperms may reach ampulla within 5 minutes.

Q.50 Write a note on significance of fertilization

Ans : Significance of fertilization:

i. Secondary oocyte completes the process of oogenesis and is transformed into a mature ovum (n).

ii. The diploid chromosome number is restored in the zygote by the process of syngamy.

iii. The ovum lacks the centrioles necessary for further division, are received from the sperm during fertilization.

iv. Fertilization involves fusion of male and female gametes from the two parents. It results in variations which are significant to evolution.

v. Sex of the offspring is determined.

INTEXT

Q.51 Fill in the blanks:

i. Secondary oocyte (egg) is ovulated after ____ surge, at about the middle of menstrual cycle.

ii. The egg that has not completed meiosis II, reaches the ampulla of uterine tube in _____ hours after ovulation.

iii. The cilia and the _____ of the fallopian tube help, direct the egg of ostium.

iv. During coitus/intercourse semen is deposited into the _____ of the female by the process of _____.

v. Human male, during ejaculation gives out about _____ ml of semen with an average count of _____ million sperms.

Ans :

i. LH ii. 12-24

iii. fimbriae

iv. vagina, insemination

v. 2-4, 200-400

Q.52 What would happen if the sperm fuses with the egg before it reaches the fallopian tube?

Ans :

i. The sperm under normal conditions would not fuse with the egg before it reaches fallopian tube.

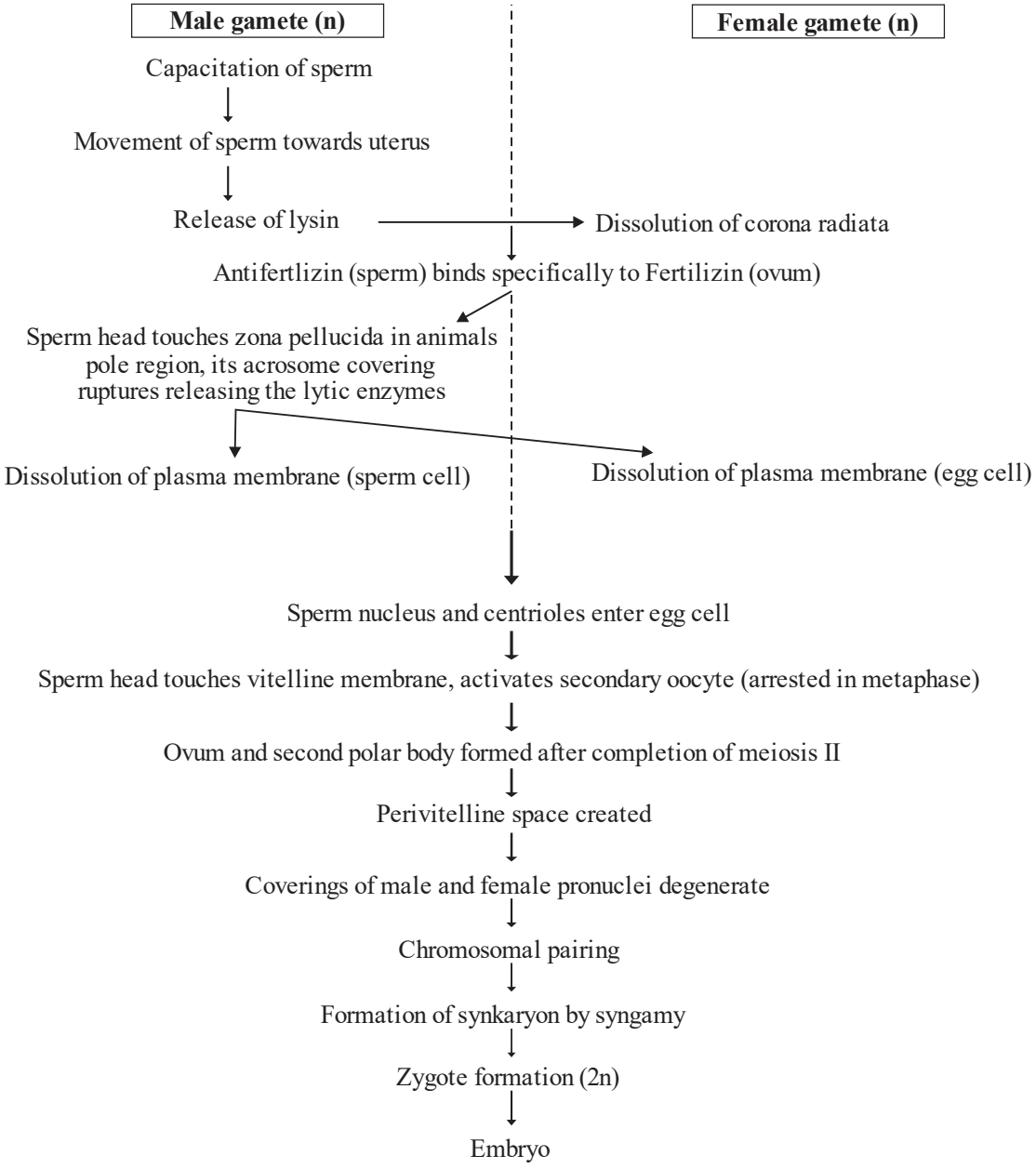
ii. The fertilized eggs needs around 7 days post-fertilization to divide before it implants itself in the uterus. If fertilization takes place earlier, it is most likely that the developed blastocyst would not be able to reach the uterus and implant itself thus pregnancy will not be able to continue till term.

INTEXT

Q.53. Activity

Prepare concept map on information of fertilization.

Ans :



Entrance Corner Set 5

i. One has to remember that the sex of the baby has been decided at this stage itself.

ii. As you know the chromosome pattern in the human female is XX and that in the male is XY. Therefore, all the haploid gametes (ova) produced by the female have the sex chromosome X whereas in the male gametes (sperms) the sex chromosome could be either X or Y, hence, 50 per cent of sperms carry the X chromosome while the other 50 per cent carry the Y.

iii. After fusion of the male and female gametes the zygote would carry either XX or XY depending on whether the sperm carrying X or Y fertilised the ovum.

iv. The zygote carrying XX would develop into a female baby and XY would form a male. That is why, scientifically it is correct to say that the sex of the baby is determined by the father and not by the mother!

MULTIPLE CHOICE QUESTIONS

Entrance Set 5

1. Fertilization in humans is practically feasible only if
   (a) the ovum and sperms are transported simultaneously to ampullary - isthmic junction of the cervix.
   (b) the sperms are transported into cervix within 48 hrs of release of ovum in uterus.
   (c) the sperms are transprted into vagina just after the release of ovum in fallopian tube.
   (d) the ovum and sperms are transported simulateneously in ampullary - isthmic junction of the fallopian tube.
2. During entry into the ovum acrosome of sperm releases
   (a) Hyaluronidase
   (b) Alkaline phosphatase
   (c) Acid phosphatase
   (d) Carbonic anhydrase
3. The glycoprotein, fertilizin is secreted by
   (a) Ovum (b) Ovary
   (c) Sperm (d) Testis
4. Sperm of animal species X cannot fertilize ovumm of species Y because _____.
   (a) Fertilizin of X and Y are not specific
   (b) Antifertilizin of X and Y are not specific
   (c) Fertilizin of X and antifertilizin of Y are not specific
   (d) Antifertilizin of X and fertilizin of Y are not specific
5. Capacitation occurs in
   (a) Rete testis
   (b) Epididymis
   (c) Vas deferens
   (d) Female Reproductive tract
6. The post-fertilization change involves,
   (a) haploid gametic maturation
   (b) introduction of centrioles in the ovum
   (c) inhibition of Meiosis II
   (d) formation of vitelline membrane

Try yourself

7. Extusion of second polar body form egg occurs
   (a) simultaneously with first cleavage
   (b) after entry of sperm but before fertilisation
   (c) after fertilisation
   (d) before entry of sperm into ovum.
8. Fertilisation in human is practically feasible only if
   (a) the ovum and sperms are transported simultaneously to ampullary-isthmic junction of the cervix
   (b) the sperms are transported into cervix within 48 hrs of release of ovum in uterus
   (c) the sperms are transported into vagina just after the release of ovum in Fallopian tube
   (d) the ovum and sperms are transported simultaneously to ampullary-isthmic junction of the Fallopian tube.
9. In human females, meiosis-II is not completed until
   (a) uterine implantation (b) birth
   (c) puberty (d) fertilisation.
10. Ectopic pregnancies are referred to as
   (a) implantation of defective embryo in the uterus
   (b) pregnancies terminated due to hormonal imbalance

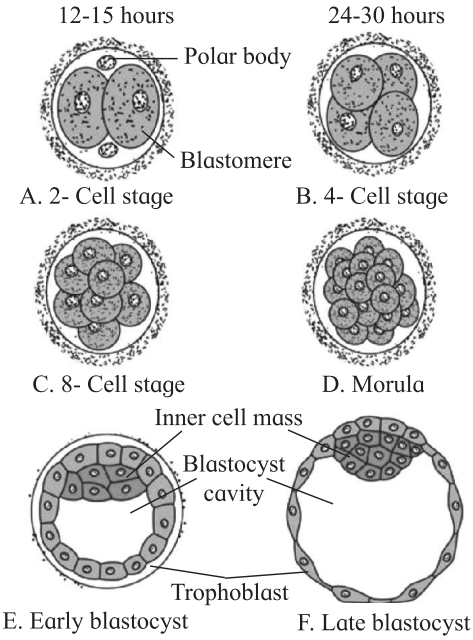
(c) pregnancies with genetic abnormality
(d) implantation of embryo at site other than uterus.

11. What happens during fertilization in humans after many sperms reach close to the ovum?
(a) Secretions of acrosome helps one sperm enter cytoplasm of ovum through zona pellucida.
(b) All sperms expect the one nearest to the ovum lose their tails.
(c) Cells of corona radiata trap all the sperms except one.
(d) Only two sperms nearest the ovum penetrate zona pellucida.

2.6 Embryonic Development

Q.54 Explain the process by which zygote divides and re-divides to form the morula

Ans : The zygote formed as a result of syngamy is activated to divide.



Process of cleavage and formation of Blastula

i. **Cleavage:**
a. It is the process of early mitotic division of the zygote into a hallow multicellular blastula.
b. It does not involve the growth of the daughter cells. The cells formed by cleavage are called **blastomeres**.
c. Since, there is no growth phase between the cleavages, the size of blastomers will be reduced with every successive cleavage.
d. As the size reduces, the metabolic rate increases.
e. Subsequent cleavages are thus faster than earlier one.
f. This requires rapid replication of DNA and high consumption of oxygen.

ii. **Process of cleavage:**
a. In human cleavage is holoblastic i.e. the whole zygote gets dividied.
b. The cleavage planes may be longitudinal or meridional and equatorial or horizontal.
c. It is radial and indeterminate i.e. fate of each blastomere is not predetermined.
d. The 1st cleavage in the zygote is meridional and occurs at about 30 hours after fertilization.
e. It divides longitudinally into two blastomeres, one slightly larger than the other.
f. The 2nd cleavage is also longitudinal but at the right angle to the 1st one and occurs after 30 hours of 1st cleavage.
g. The 3rd cleavage is horizontal. After 3rd cleavage the embryo is in 8-cell stage.
h. As the cleavage are going on the young embryo is, gradually being pushed towards the uterus.
i. By the end of 4th day after fertilization, embryo is a solid ball of 16-32 cells and externally looking like mulberry. This stage is thus called **morula**.

iii. **Morula:** The morula shows cells of two types:
a. Smaller, clearer cells towards the outer side and Inner cell mass of larger cells.
b. Cells are compactly arranged.
c. Till the formation of morula the zona pellucida is retained around the embryo and thus, there is no change in the overall size from zygote to morula.
d. The morula reaches the isthmus and gains entry into the uterus by the end of day four.

Q.55 Describe the process of blastulation in detail.

Ans :

i. Blastulation is the process of formation of the hollow and multicellular blastocyst.

ii. The embryo (blastocyst) that enters the uterus remains floating in uterine cavity for 2-4 days after its entry i.e. till the end of 7th day after fertilization.

iii. The outer layer of cells seen in the morula now form the layer called **trophoblast**.

iv. Cells from the trophoblast begin to absorb the glycogen rich uterine milk.

v. The blastocyst doubles in size from 0.15 mm to 0.30 mm.

vi. With more fluid entering inside the blastocyst cavity is formed.

vii. These outer cells become flat and are called **trophoblast cells** (since they help only in absorbing nutrition for the developing embryo).

viii. The inner larger cells form **inner cell mass** or **embryobast** (the embryo proper develops from the embryoblasts). These remain attached to the trophoblasts on only one side.

ix. The trophoblast cells in contact with the embryonal knob are called cells of Rauber.

x. At this stage the blastocyst shows polarity.

xi. The side with inner cell mass is called the embryonal end and the side opposite to it is the abembryonal end.

xii. By the end of the 7th day of blastocyst is fully formed. It is now ready for implantation and gastrulation.

xiii. The function of zona pellucida is to prevent the implantation of the embryo at an abnormal site.

xiv. It does not expose the sticky and phagocytic trophoblast cells till it reaches the implantation site i.e. within the uterus, hence zona pellucida now ruptures.

TEXTUAL

★Q.56 Describe the structure of blastulla.

Ans : *Refer Q.55.*

Q.57 Which stage of embryo gets implanted in the uterus? Write a note on duration, site and process of implantation.

Ans :

i. The blastocyst after its formation, gets implanted or embedded into the endometrium of the uterus.

ii. This process usually begins on day 7 after fertilization and by end of 10th day, the embryo is completely burried inside tthe endometrium.

iii. The embryo usually implants in the region of the fundus of uterus.

iv. In the process, the embryo attaches itself by its embryonic pole, close to the endometrium.

v. The trophoblast cells of the animal pole have the power to stick to the uterine wall.

vi. Rapid division of the trophoblast cells lying against the embryonal knob takes place.

vii. It results in the formation of two distinct layers- **syncytiotrophoblast** and cytotrophoblast.

viii. The outer layer, syncytiotrophoblast is syncytium i.e. a layer of protoplasm with many nuclei. It gives out processes which extensively invade the endometrium.

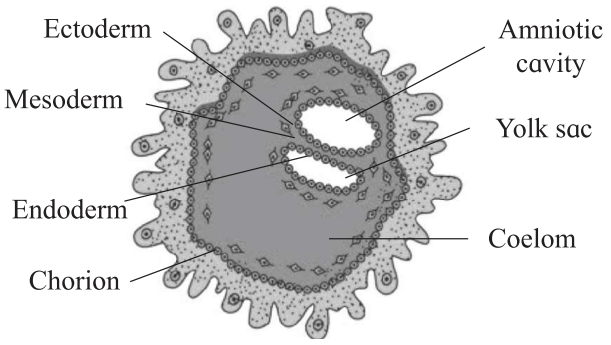
ix. The lytic enzymes secreted by the trophoblasts, rupture the endometrial cells thereby making a burrow, into which the embryo begins to get implanted.

x. By the end of the 10th day the whole embryo is deeply embedded into the endometrium, completing the process of implantation.

xi. The inner layer of cells is called **cytotrophoblast** (cels with defined membrane) since, the cells retain their cell boundaries.

Q.58 Write a note on gastrulation and describe the whole process in detail.

Ans :



V.S. of late Grastrula

i. Gastrulation is the process of formation of 'gastrula' from the blastocyst.

ii. In the gastrula stage, there is slowing of the rate of cleavage or divisions but there are two important events that take place actively :
   a. **Differentiation of blastomeres:** This process results in the formation of three germinal layers i.e. ectoderm, mesoderm and endoderm from the cells of the embryoblast.
   b. **Morphogenetic movements:** These are different types of movements to reach their definite place in the embryo.

iii. Gastrulation begins in the embryoblast cells on about 8th day after fertilization. Cell on the free end of inner cell mass called hypoblasts (primitive endoderm) become flatend, start dividing and grows downward towards the blastocoel, cavity of blastocyst.

iv. This layer called endoderm is first to differentiate. It grows within the blastocoel and forms a sac called Yok sac.

v. The remaining cell of the inner cell mass, in contact with cells of Rauber are called epiblasts (primary ectodern).

vi. Both layers form a flat, bilaminar embryonal disc.

vii. After formation of endoderm the second layer to be differentiated is the ectoderm.

viii. Cells of epiblast divide and redivide and move in such a way that they enclose the amiotic cavity.

ix. The floor of this cavity has the embryonal disc.

x. The pyramidal cells of the disc towards the amniotic cavity form the embryonal ectoderm.

xi. The roof of amniotic cavity is lined by amniogenic cells. Later, these cells divide and redivide to form the amnion.

xii. Amnion is an extra embryonic membrane that surrrounds and protects the embryo.

xiii. As a result of all these change, the bilaminar embryonic disc is positioned in between amniotic cavity and Yolk sac.

xiv. **Process of gastrulation:**
   a. Actual gastrulation occurs about 15 days after fertilization, in which the bilaminar embryonic disc is transformed into trilaminar embryonic disc.
   b. This transformation occurs by division rearrangement and migration of cells of epiblast.
   c. It begins with formation of primitive streak and a shallow groove on the surface is called primitive groove. This streak progresses from posterior to anterior end of embryo.
   d. From site of a primitive streak, a third layer of cells called mesoderm extends between ectoderm and endoderm.
   e. Anterior end of primitive groove communicates with yolk sac by an aperture called blastopore (future anus.)
   f. The embryonal disc now has differentiated into three layers-ectoderm, mesoderm and endoderm.
   g. The further process after gastrulation is called organogenesis.

Q.59 Write a note on stem cells.

Ans :

i. Stem cells are undifferentiated somatic cells of a multicellular organism.

ii. They are capable of giving rise to many more cells of the same type or they can also differentiate into other type of cells.

iii. Bone marrow cells, blood stem cells cord cells or umbilical cord cells are examples of stem cells.

iv. They can be used in the treatment of Parkinson's disease, Alzheimer's disease, Diabetes, Leukemia, Arthritis, etc.

Q.60 Write a note on fate of germinal layers.

Ans : The fate of three germinal layers is as follows:

i. **Ectoderm:**

Ectoderm gives rise to epidermis of skin, hair, nails, sweat glands, salivary glands, mammary glands, lacrimal glands, sebaceous glands, cornea, lens, retina, conjunctiva, nasal epithelieum, enamel of teeth, internal and external ear, foregut, hindgut, adrenal medulla, anterior and posterior pituitary, pineal gland, entire nervous system.

ii. **Mesoderm:**
Mesoderm forms all types of muscles (except iris muscles and ciliary muscles of eye which originate from ectoderm), connective tissues, dermis of skin, adrenal cortex, heart, blood, blood vessels, lymphatic vessels, middle ear, dentine of teeth, urinary and reproductive ducts, gonads, kidneys, sclera and choroid of eye.

iii. **Endoderm:**
Endoderm develops into epithelium of mid-gut, glands of stomach and intestine, tongue, tonsils, lungs, trachea, bronchi, larynx, urinary bladder, vagina, liver, pancreas, thyroid gland, parathyroid gland, thymus gland, Eustachian tube, epithelium of urethra, lining of middle ear.

TEXTUAL

★Q.61 Where does fertilization and implantation occur?

Ans : Fertilization usually occurs in the ampulla of the fallopian tube, while implantation occurs in the endometrium of the uterus.

TEXTUAL

★Q.62 What is the difference between embryo and zygote?

Ans :

	Embryo	Zygote
i.	Embryo is multicellular	Zygote is unicelluar
ii.	Embryo occurs after zygote formation	Zygote is the first stage of development after fertilization
iii.	Embryo is formed as a result of embryogenesis	Zygote is formed as a result of fertilization
iv.	It forms in the uterus	It forms in the fallopian tube

INTEXT

Q.63 What is meroblastic cleavage? In which organisms, it is observed?

Ans :

i. Meroblastic cleavage unlike holoblastic cleavage does not divided the embryo entirely.

ii. It occurs in very yolky eggs like the eggs of birds, reptiles and some fishes.

Q.64 Can you recall?
What do you mean by Monozygotic, Dizygotic twins and conjoined twins?

Ans :

i. **Monozygotic twins:** The cells of single embryo divided into two groups and develop as two separate embryos as these are basically the same embryo they are genetically identical. Thus, called as Monozygotic twins, they have identical appearance as well as gender.

ii. **Dizygotic twins:** Sometimes, two oocytes are released from the ovary and both are fertilized by two separate sperms. This leads to formation of two zygotes which inturn form two separate embryos. These embryos are implanted separately in the uterus as well. Such twins are thus known as dizygotic twins, they are genetically different and maybe of same or different gender.

iii. **Conjoined twins:** Conjoined twins are formed when embryo of destined monozygotic twins separates only partially to form two individual. Conjoined twins are joined to each other, even may share organs. Most conjoined twins are stillborn or die shortly after birth.

TEXTUAL

★Q.65 Give two differences between blastula and gastrula.

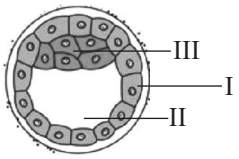
Ans :

	Blastula	Gastrula
i.	It is formed early by the process of blastulation.	It is formed later by the process of gastrulation
ii.	It is formed from morula	It is formed from blastula
iii.	Germinal layers are absent	Germinal layers are present
iv.	Cells are undifferentiated	Cells undergo differentiation

MULTIPLE CHOICE QUESTIONS

Entrance Set 6

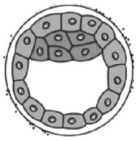
1. Morula formed at the end of cleavage is ____ celled.
   (a) 14 (b) 16
   (c) 18 (d) 20
2. During embryonic development, after third cleavage the number of blastomeres formed will be _____.
   (a) 8 (b) 10
   (c) 16 (d) 6
3. Choose the CORRECT group of labellings.



   (a) I - Trophoblast, II - Archenteron, III - Micromeres
   (b) I - Trophoblast, II - Blastocoel, III - Megameres
   (c) I - Trophoblast, II - Archenteron, III - Inner mass cells
   (d) I - Trophoblast, II - Blastocoel, III - Inner mass cells
4. The process by which primary germinal layers are formed is called
   (a) Blastulation (b) Cleavage
   (c) Gastrulation (d) Implantation
5. The CORRECT sequence of embryonic development is
   (a) Blastula - Morula - Zygote - Gastrula - Embryo
   (b) Zygote - Blastula - Morula - Gastrula - Embryo
   (c) Zygote - Morula - Blastula - Gastrula - Embryo
   (d) Gastrula - Morula - Zygote - Blastula - Embryo
6. Nervous system is derived from the following germinal layer
   (a) mesoderm (b) endoderm
   (c) ectoderm (d) meso-endoderm

Try yourself

7. Ectoderm gives rise to
   (a) cornea, heart, bronchi, dentine
   (b) adrenal, cortex, tongue, liver, retina
   (c) enamel of teeth, nails, adrenal medulla, hair
8. Select the CORRECT pair of endodermal derivatives.
   (a) Adrenal medulla - Dermis of skin
   (b) Lungs - Thyroid gland
   (c) Lymphatic vessel - Vagina
   (d) Retina - Tonsil
9. The amnion of mammalian embryo is derived from
   (a) ectoderm and mesoderm
   (b) endoderm and mesoderm
   (c) mesoderm and trophoblast
   (d) ectoderm and endoderm
10. Identify the human developmental stage shown below as well as the related right place of its occurrence in a normal pregnant woman, and select the right option for the two together.



Developmental stage		Site of occurrence
a. Late morula	–	Middle part of Fallopian tube
b. Blastula	–	End part of Fallopian tube
c. Blastocyst	–	Uterine wall
d. 8-celled morula	–	Starting point of Fallopian tube

11. Which one of the following statements about morual in humans is correct?
   (a) It has almost equal quantity of cytoplasm as an uncleaved zygote but much more DNA.
   (b) It has far less cytoplasm as well as less DNA than in an uncleaved zygote.
   (c) It has more or less equal quantity of cytoplasm and DNA as in uncleaved zygote.

(d) It has more cytoplasm and more DNA than an uncleaved zygote.

2.7 Pregnancy

Q.66 What is pregnancy? Describe the three trimesters of pregnancy in detail.

Ans :

i. Pregnancy is the condition of carrying one or more embryos in the uterus. It is also called **gestation**.

ii. It refers to the period between fertilization of the egg, upto parturition.

iii. The average period of pregnancy in human lasts for 266 days from fertilizaton or **280 days** (266 + 14) counted from LMC-Last Mensturation Cycle.

iv. This pregnancy period of approximately nine months is divided into three trimesters of three months each.

v. **First Trimester (from fertilization to 12th week):**
   a. It is the time of most radical changes in mother and embryo.
   b. The embryo receives nutrients in the first 2-4 weeks directly from the endomerium.
   c. It is the main period of organogenesis and the development of body organs.
   d. By the end of eight weeks, the major structures found in the adult are formed in the embryo in a rudimentary form.
   e. The embryo is now called foetus. It is about 3cm long. Arms, hands, fingers, feet, toes are formed.
   f. Foetus can open and close mouth and fists.
   g. CNS is fully formed, working of excretory and circulatory systems begins.
   h. Movements of foetus begin but mother can not feel it. Heart beat can be heard from 6th week.
   i. Progesterone level becomes high and menstual cycle is suspended till the end of pregnancy. At the end of first trimester foetus is about 7-10 cm long.
   j. Meanwhile, the mother's body also undergoes rapid changes. High levels of progesterone initiate changes in her reproductive system.
   k. The maternal part of placenta grows, the uterus becomes larger. In this period, the mother experiences 'morning sickness' (nausea, vomiting, mood swings, etc.).

vi. **Second Trimester (from 13th to 26th week):**
   a. It is the period of rapid growth of foetus.
   b. The uterus grows enough for the pregnancy to become abvious.
   c. The foetus is very active and grows to about 30 cms. Development of brain begins.
   d. Hormone levels stabilize as hCG declines, the corpus luteum deteriorates (regresses) and the placenta completely takes over the production of progesterone which maintains the pregnancy.
   e. Ultrasound (sonography) at 18-20 weeks shows baby's growth and position.
   f. From this estimated due date of delivery can be established.
   g. Baby's movements can be easily felt by the mother.
   h. Head has hair, eyebrows and eyelashes appear, pinnae are distinct. The baby reaches half the size of a newborn.

viii. **Third (final) Trimester (from 27th week till the parturition):**
   a. The foetus grows to about 3-4 kg in weight and 50 cms in length.
   b. Eyes are open. There is gain in body weight.
   c. As the foetus grows, the uterus expands around it, the mother's abdominal organs become compressed and displaced, leading to frequent urination, digestive blackages and strain in the back muscles.
   d. At the end of third trimester the foetus becomes fully developed and ready for parturition.

TEXTUAL

★Q.67 What is the difference between a foetus and an embryo?

Ans : We refer to the developing organism from fertilization to the end of eight weeks as

embryo, after that embryo develops into a foetus. Foetus is the developing organism from the beginning of the third month of birth.

MULTIPLE CHOICE QUESTIONS

Entrance Set 7

1. In the second trimester of pregnancy, there is decline in the level of _____.
   (a) ACTH (b) ICSH
   (c) hCG (d) MSH
2. The unique feature observed in the foetus during fifth month of pregnancy
   (a) body covered with fine hair
   (b) development of limbs
   (c) appearance of hair on head
   (d) formation of heart
3. The first movements of the foetus and appearance of hair on its head are usually observed during which month of pregnancy?
   (a) Fourth month (b) Fifth month
   (c) Sixth month (d) Third month
4. Amniotic fluid protects the foetus from
   (a) Degeneration (b) Jerks
   (c) Encystment (d) None
5. Urinary bladder of the embryo is or which is the urinary bladder of child placed in the womb
   (a) Yolk sac
   (b) Allantois
   (c) Amnion
   (d) Chorion and allantois both

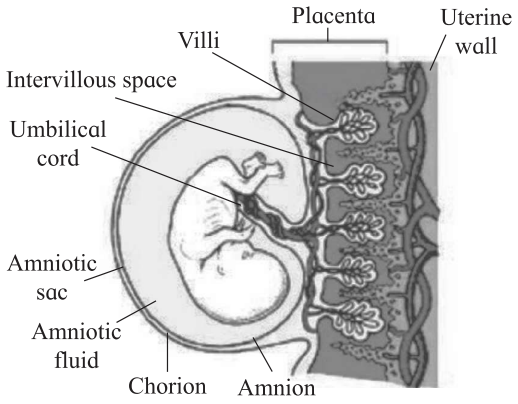
Try yourself

6. The main function of tropho ectoderm in mammalian embryo is
   (a) Protection of the developing cells
   (b) Drawing food for the developing cells
   (c) Formation of yolksac
   (d) Formation of body of developing embryo
7. Foetal membranes provide
   (a) Protection to embryo
   (b) Nutrition to embryo
   (c) Protection and nutrition to embryo
   (d) None of these
8. Amnion helps in
   (a) Respiration
   (b) Excretion
   (c) Nutrition
   (d) Protection from shocks
9. The extra embryonic membranes of the mammalian embryo are derived from
   (a) Formative cells (b) Follicle cells
   (c) Trophoblast (d) Inner cell mass
10. The number of foetal membranes in man is
    (a) 2 (b) 3
    (c) 4 (d) 0

2.8 Placenta

Q.68 Write a detailed note on structure and function of placenta.

Ans :



Placenta

i. Placenta is a flattened, discoidal organ in the uterus of a pregnant woman.

ii. The placenta is a temporary structural and functional connection between foetal and maternal circulation.

iii. The placenta facilitate the suppy of oxygen and nutrients and also for removal of carbon dioxide and excretory wastes produced by the foetus.

iv. The placenta is attached to the wall of the uterus and to the baby's umbilical cord.

v. Placenta is the only organ, which is formed of tissues from two different individuals- the mother and the foetus.

vi. Part of the placenta contributed by the foetus is called the foetal placenta and it is the **chorionic villi**.

vii. The other part which is rich in blood supply shared by the mother.

viii. It is a part of uterine wall, termed **as maternal**

placenta. So human placenta is called **haemochorial**.

ix. The umbilical cord is formed of three blood vessels.

x. Of these three blood vessels, two are small arteries which carry blood towards the placenta and one is a large vein which returns blood to the foetus.

xi. The placenta also acts as an endocrine tissue and produces hormones like hCG, progesterone, estrogen while relaxin is secreted by the ovary in the later phase of pregnancy.

xii. Level of hCG increases upto the end of first trimester and then it declines.

xiii. By the ened of first trimester progesterone is produced by placenta. These hormones are required for foetal growth and maintenance of pregnancy.

Q.69 Write a note on cord blood

Ans :

i. Cord blood (umbilical cord blood) is the blood that remains in the umbilical cord and placenta, post delivery.

ii. Cord blood is rich in stem cells that can transform into all sorts of blood cells.

iii. They can be used to treat diseases that harm the blood and immune system e.g. leukemia, certain cancers, sickle cell anemia and some metabolic disorders.

Q.70 What do you mean by cord blood banking?

Ans : Cord blood banking is the process of collecting the cord blood, extraction and cyrogenically preserving for its stem cells and other cells of the immune system for future potential medical use.

Q.71 Name the hormones produced in women only during pregnancy.

Ans : hCG, HPL (Human Placental Lactogen).

MULTIPLE CHOICE QUESTIONS

Entrance Set 8

1. Which one of the following is NOT the function of placenta?
   (a) It facilitates supply of oxygen and nutrients to embryo
   (b) It secretes estrogen
   (c) It facilitates removal of carbon dioxide and waste material from embryo
   (d) It secretes oxytocin during parturition.

2. Hormones secreted by the placenta to maintain pregnancy are
   (a) hCG, hPL, progestogens, estrogens
   (b) hCG, hPL, estrogens, relaxin, oxytocin
   (c) hCG, hPL, progestogens, prolactin
   (d) hGC, progestogens, estrogens, glucocorticoids

3. Several hormones like hCG, hPL, estrogen, progesterone are produced by
   (a) Pituitary (b) Ovary
   (c) Placenta (d) Fallopain tube

4. hCG is secreted by _____.
   (a) Allantois (b) Corona radiata
   (c) Corpus luteum (d) Placenta

5. The hormone relaxin, responsible for easy birth of the baby is secreted by _____.
   (a) Graafian follicle
   (b) Corpus callosum
   (c) Corpus luteum
   (d) Corpus albicans

6. Which of the following hormones is responsible for both the milk ejection reflex and the foetal ejection reflex?
   (a) Relaxin (b) Estrogen
   (c) Prolactin (d) Oxytocin

8. Several hormones like hCG, hPL, estrogen, progesterone are produced by
   (a) Ovary (b) Placenta
   (c) Fallopian tube (c) Pituitary.

9. Which one of the following is not the function of placenta?
   (a) Facilitates removal of carbon dioxide and waste material from embryo
   (b) Secretes oxytocin during parturition
   (c) Facilities supply of oxygen and nutrients to embryo
   (d) Secretes estrogen

10. The layer of uterus which becomes much eroded due to placental villi is known as
    (a) Endothelium (b) Endometrium
    (c) Endoderm (d) Trophoblast

Try yourself

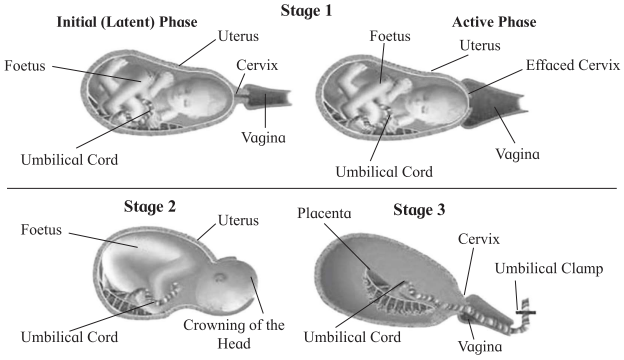
11. Placenta is present in
    (a) All mammals (b) Metatherians
    (c) Eutherians (d) Prototherians
12. To ensure effectiveness of reproduction in mammals
    (a) Formation of yolk sac
    (b) Retention of yolk sac
    (c) Reduced number of egg
    (d) Formation of placenta
13. The eutherian placenta is derived from or In mammals placenta is formed by
    (a) Yolk sac
    (b) Amnion
    (c) Allantois
    (d) Chorion allantois
14. In man developing embryo remains in
    (a) Vagina (b) Uterus
    (c) Fallopian tube (d) Ovaries
15. Endometrium is found in
    (a) Placenta of mammals
    (b) Nipple of mammals
    (c) Uterus of mammals
    (d) None of these
16. The type of placenta found in human beings is of type
    (a) Diffuse (b) Zonary
    (c) Cotyledonary (d) Discoidal
17. The extra structure that provides nutrition to the embryo is
    (a) Umbilicus (b) Amnion
    (c) Chorion (d) Placenta

2.9 Parturition

TEXTUAL

★Q.72 Explain the steps of parturition

Ans :



i. Parturition is the process of giving birth to a baby.

ii. The physical activities involved in parturition like uterine and abdominal contractions, dilation of cervix and passage of baby are collectively called labour.

iii. Labour is accompanied by localised sensation of discomfort or agony called labour pains.

iv. It involves the following three steps:
   a. Uterine contractions begin from top, forcing the baby towards the cervix.
   b. Contractions are accompanied by pain caused by compression of blood vessels.
   c. Oxytocin induced uterine contractions become stronger and stronger due to stimulatory reflex.
   d. As the baby is pushed down in the uterus, its head come to lie against cervix.
   e. Cervix gets dilated. The vagina also shows similar dilation.
   f. This stage of labour can normally last upto few hours.
   g. It ends in rupturing of amniotic membrane of foetus.

v. **Expulsion stage:**
   a. The uterine and abdominal contractions become stronger.
   b. In normal delivery, the foetus passes out through cervix and vagina with head in forward direction. It takes 20 to 60 min.
   c. The umbilical cord is tied and cut off close to the baby's navel.

vi. **After birth:**
   a. After the delivery of the baby the placenta separates from the uterus and is expelled out as "after birth", due to severe contractions of the uterus.
   b. This process happens within 10 to 45 minutes of delivery.

TEXTUAL

★Q.73 Which hormoes are induced in parturition?

Ans :

i. Parturition is controlled by a complex neuroendocrine mechanism. Signals arise from the fully formed foetus and placenta

cause mild uterine contractions.

ii. It is accompanied by rise in estrogen-progesterone ratio, increase in oxytocin receptors in uterine muscles.

iii. They cause vigorous contractions of myometrium of uterus at the end of pregnancy.

iv. The fully developed foetus gives signals for the uterine contractions by secreting Adrenocorticotropic Hormone (ACTH) from pituitary and corticosteroids from adrenal gland.

v. This triggers release of oxytocin from mother's pituitary gland, which acts on uterine muscles of mother and causes vigourous uterine contractions. This leads to expulsion of the baby from the uterus.

MULTIPLE CHOICE QUESTIONS

Entrance Set 9

1. Forceful muscular contractions of uterine wall is involved in
(a) Implantation (b) Lactation
(c) Micturition (d) Parturition

2. Which of the following hormones initiates parturition?
(a) ACTH, hCG, Oxytocin
(b) ACTH, Corticosteroid, Oxytocin
(c) Corticosteroid, ACTH, Prostaglandin
(d) ACTH, Progesterone, hCG

3. What is "After birth" referred to?
(a) Amniotic fluid passing out
(b) Expulsion of baby
(c) Expulsion of placenta, umbilical cord and foetal membrane
(d) Secretion of hormone relaxin

4. Which of these is NOT an important component of initiation of parturition in human?
(a) Increase in estrogen and progesterone ratio
(b) Synthesis of prostaglandins
(c) Release of oxytocin
(d) Release of prolactin.

5. The signals for the parturition process originate from
(a) muscles of uterus
(b) fully developed foetus and placenta
(c) placenta
(d) hormones of ovaries and uterus

6. Which of these is not an important component of initation of parturition in humans?
(a) Release of oxytocin
(b) Release of prolactin
(c) Increase in estrogen and progesterone ratio
(d) Synthesis of prostaglandins

7. The fetal ejection reflex in humans triggers the release of
(a) oxytocin from foetal pituitary
(b) human chorionic gonadotropin (hCG) from placenta
(c) human placental lactogen (hPL) form placenta

8. Signals for parturition originate form
(a) both placenta as well as fully developed fetus
(b) oxytocin released from maternal pituitary
(c) placenta only
(d) fully developed fetus only.

9. Signals from fully developed fetus and placenta ultimately lead to parturition which requires the release of
(a) estrogen from placenta
(b) oxytocin from maternal pituitary
(c) oxytocin from fetal pituitary
(d) relaxin from placenta.

10. The gestation period of elephants is about
(a) 11 months (b) 10 months
(c) 15 months (d) 22 months

11. The shortest gestation period is seen in
(a) Man (b) Elephant
(c) Cat (d) Mouse

12. The layer of uterus which becomes much eroded due to placental villi is known as
(a) Endothelium (b) Endometrium
(c) Endoderm (d) Trophoblast

13. The longest gestation period is found in
(a) Elephant (b) Gorilla
(c) Chimpanzee (d) Man

14. The gestation period of rabbit is
(a) 28–32 days (b) 20–25 days
(c) 60–70 days (d) 80–90 days

15. Gestation period in human beings is about
(a) 10 weeks (b) 28 weeks
(c) 32 weeks (d) 36 weeks

16. Gestation period is the duration
(a) Of fertilization
(b) Between egg growth and ovulation
(c) Between fertilization and parturition
(d) None of the above

2.10 Lactation

Q.74 Write a note on Lactation

Ans :

i. The mammary glands of the female start producing milk at the end of pregnancy by the process of lactation.

ii. Prolactin is the hormone which is responsible for production of milk.

TEXTUAL

★Q.75 What is Colostrum?

Ans :

i. Colostrum is the sticky and yellow fluid secreted by the mammary glands soon after child birth.

ii. It contains proteins, lactose and mother's antibodies e.g. IgA.

iii. The fat content in colostrum is low.

iv. he antibodies present in it helps in developing resistance for the new born baby at a time when its own immune response is not fully developed.

INTEXT QUESTION

Q.76 Use your brain power
Why is it said that consumption of mother milk is safest for the new born?

Ans :

i. A newborn child has negligible or extremely weak immunity and thus needs to be nourished well to ensure proper growth an development.

ii. Mother's milk contains fatty acids, lactose, amino acids, minerals, vitamins, and water required for baby's digestion, brain development, and growth.

iii. The initial colostrum and maternal milk contains antibodies which helps in strengthening the immune system of the baby.

iv. Usage of bottles, feeders, etc., for feeding have shown to increase incidences of diarrhea in children and are unsafe for the newborn.

2.11 Reproductive Health

Q.77 Define Reproductive health?

Ans : Reproductive health means total wellbeing in all aspects of reproduction-its emotional, behavioural and social aspects along with the physical ones.

Q.78 What are goals of RCH programme.

Ans : Goals of RCH Programmes are as follows:

i. To create awareness among people about various aspects related to reproduction.

ii. To provide the facilities to people to understand and build up reproductive health.

iii. To provide support for building up a reproductively healthy society.

iv. To bring about a change mainly in three critical health indicators i.e. reducing total infertility rate, infant mortality rate and maternal mortality rate.

Q.79 What are the ways the goals of RCH can be achieved?

Ans : The goals of RCH can be achieved by following ways:

i. By introduction of sex education in schools. Schools should be encouraged to provide correct information to the young so as to discourage children from believing in myths and clear the misconceptions about sex related aspects. Proper information about safe and hygenic sexual practices, sexually transmitted diseases (STD, AIDS), problems related to adolescence and proper information about reproductive organs.

ii. With the help of audio- visual and the print media, government and non-government organisations should take various steps to create awareness about various aspects related to reproduction.

iii. By educating the younger generation about birth control measures, pre-natal care of pregnant woman and post-natal care of the mother and child, importance of breast feeding.

iv. By developing awareness about problems arising due to uncontrolled population growth, social evils like sex abuse and sex related crimes and take up necessary steps to prevent them.

v. By creating awareness about statutory ban an amniocentesis for sex determination.

vi. By creating awareness about child immunization programmes.

vii. By educating couples to reduce mortality rate of new borns and maternal mortality rate.

2.12 Birth control

Q.80 Write a note on contraceptives and state the features of an ideal contraceptive.

Ans :

i. The birth control measures which deliberately prevent fertilization are referred to as contraceptives.

ii. The contraceptive methods help to prevent unwanted pregnancies.

iii. An ideal contraceptive should be easily available, user friendly, effective and with no or least side effects.

Q.81 Explain temporary contraceptive methods in detail.

Ans : Temporary contraceptive methods are of following types:

1. Natural method/Safe period/Rhythm method:

i. In the natural method, the principle of avoiding chances of fertilization is used.

ii. A week before and a week after menstrual bleeding is considered the safe period for sexual intercourse.

iii. This idea is based on the fact that ovulation occurs on the 14th day of menstrual cycle.

iv. Its drawback lies in having a high rate of failure.

2. **Coitus Interruptus or withdrawal:**

i. In this method, the male partner withdraws his penis from the vagina just before ejaculation, so as to avoid insemination.

ii. This method also has some drawbacks, as the pre-ejaculation fluid may contain sperms and this can cause fertilization.

3. **Lactational amenorrheao (absence of menstruation):**

i. This method is based on the fact that ovulation does not occur during the period of intense lactation following parturition.

ii. Therefore, as long as the mother breastfeeds the child fully, chances of conception are almost negligible.

iii. However, this method also has high chances of failure.

4. **Chemical means (spermicides):**

i. In this method, chemicals like foam, tablets, jellies, and creams are used by the female partner.

ii. Before sexual intercourse, if these chemicals are introduced into the vagina, they adhere to the mucous membrane, immobilize and kill the sperms.

iii. It may cause allergic reaction. This method also has chances of failure.

5. **Mechanical means/Barrier methods:**

In this method, with the help of barriers the ovum and sperm are prevented from physically meeting. These mechanical barriers are of three types.

i. **Condom:**

a. It is a thin rubber sheath that is used to cover the penis of the male during copulation.

b. It prevents the entry of ejaculated semen into the female reproductive tract. This can prevent conception.

c. It is a simple and effective method and has no side effects.

d. "Nirodh" is the most widely used contraceptive by males.

e. It is easily available and is given free by the government.

f. It should be properly discarded after every use.

g. Condom is also a safeguard against STDs and AIDS.

ii. **Diaphragm, cervical caps and vaults:**

a. These devices used by the female are made up of rubber.

b. They prevent conception by blocking the

entry of sperms through the cervix.

c. The device is inserted into the female reproductive tract to cover the cervix during copulation.

iii. **Intra-uterine devices (IUDs):**

a. These clinical devices are plastic or metal objects. A doctor or trained nurse places the IUDs into the uterus.

b. These devices include Lippes loop, copper releasing IUDs (Cu-T, Cu7, multiload 375) and hormone releasing IUDs (LNG-20, progestasert).

c. Lippes loop is a plastic double "s" loop. It attracts the macrophages stimulating them to accumulate in the uterine cavity.

d. Macrophages increase phagocytosis of sperms within the uterus and acts as a contraceptive.

e. Copper releasing IUDs suppress sperm motility and the fertilising capacity of sperms.

f. The hormone releasing IUDs make the uterus unsuitable for implantation and cervix hostile to the sperms.

g. It delays pregnancy for longer period. The spontaneous expulsion, occasional haemorrhage and changes of infection are the drawback of IUDs.

6. **Physiological (Oral) Devices:**

i. Physiological devices are used in the form of tablets and hence are popularly called pills.

ii. It is an oral contraceptive, used by the female.

iii. The pill contains progesteron and estrogen.

iv. They inhibit ovulation, hence no eggs are released from the ovary of the female using this pill and thus conception cannot occur.

v. They also alter the quality of cervical mucus to prevent the entry of sperms.

vi. This pills have side effects such as nausea, weight gain, tenderness of breast and slight blood loss between menstrual periods.

vii. The pill **"Saheli"** is an oral contraceptive for females which is nonsteroidal.

viii. Saheli is to be taken once in a week.

ix. These pills are sponsored by the Government.

7. **Other contraceptives:**

i. The birth control **implant** is a contraceptive used by the female.

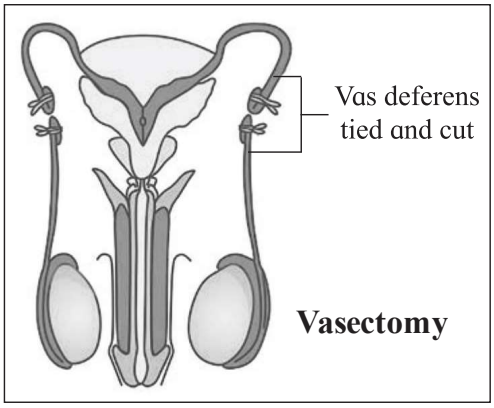
ii. It is a tiny, thin rod about the size of a match stick.

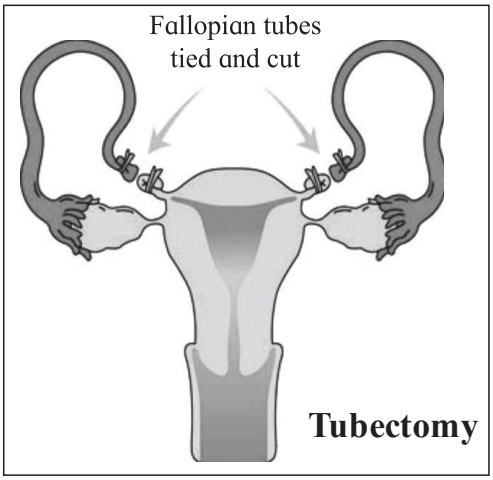
iii. It is implanted under the skin of the upper arm.

iv. They contain progesterone and estrogen. Their mode of action is similar to that of pills. They prevent pregnancy for 3-4 years.

Q.82 Write a note on permanent contraceptical method.

Ans :





i. The permanent birth control method in men is called vasectomy and in women it is called tubectomy.

ii. These are surgical methods, also called sterilization.

iii. In vasectomy a small part of the vas deferens is tied and cut where as in tubectomy, a small part of the fallopian tube is tied and cut.

iv. This blocks, gamete transport and prevent pregnancy.

Q.83 What is MTP? Write a note on MTP Act 1971.

Ans :

i. An intentional or voluntary termination of pregnancy before full term is called Medical termination of Pregnancy (MTP) or induced abortion.

ii. MTP is essential in cases of unwanted pregnancies or in defective development of foetus. It is safe during the first trimester of pregnancy.

iii. Government of India has legalised MTP Act in 1971, with strict conditions to avoid its misuse.

iv. Medical Termination of Pregnancy (Amendment) Act 2017 under section 3 of the MTP Act 1971 was eneacted by Government of India.

v. The intention of MTP Act is to reduce the incidence of illegal abortion and consequent maternal mortality. As per the provisions of the MTP Act, only the consent of woman whose pregnancy is being terminated is required.

vi. According to MTP Act pregnancy may be terminated :
   a. Within first 12 weeks
   b. More than 12 weeks but lesser than 20 weeks.

vii. The registered medical practitioner's opinion is mandatory stating the continuation of the pregnancy would involve a risk to the life of the pregnant woman or grave abnormal physical or mental health or is substantial risk to the child.

Q.84 Explain amniocentesis in detail.

Ans :

i. Amniocentesis is a process in which amniotic fluid containing foetal cells is collected using a hollow needle inserted into the uterus under ultrasound guidance.

ii. The chromosomes are studied to see the abnormalities in the developing foetus.

iii. But the dangerous trend is the misuse of amniocentesis to determine the sex of the unborn child.

TEXTUAL

★Q.85 Describe the various methods of birth control to avoid pregnancy.

Ans : Refer Q.81.

★Q.86 Comment on any two mechanical contraceptive methods.

Ans : Refer Q.81.

★Q.87 Write a note on tubectomy.

Ans :

i. The permanent birth control method in women is called as tubectomy.

ii. In tubectomy, a small part of the fallopain tube is cut and tied.

iii. This blocks, gamete transport and prevents pregnancy.

iv. This technique is highly effective though its reversibility is very poor.

INTEXT

Q.88 Activity

In a sonography clinic, we observe a board saying 'Sex selection and detection is NOT done in this centre and is punishable under PC-PNDT Act; Find out what is PC-PNDT Act. Why do you think such a mandate is essential?

Ans :

i. The PC-PNDT (Pre-Conception & Pre-Natal Diagnostic Techniques) Act was enacted on 20 September 1994 with the intent to prohibit prenatal diagnostic techniques for determination of the sex of the foetus leading to female foeticide.

ii. The preliminary objective of implementing such an Act was to put a check on increasing rate of female foeticide.

iii. A decline in the national male; female sex ratio increased stringency of banning sex determination.

iv. Defaulters will be punished either by suspension of registration, filing of criminal cases and sealing of machines. Besides, criminal prosecution, defaulters will also bring in suspension and cancellation of registration granted by the Sate Medical Council.

v. Sex selection and detection is prohibited and is punishable and this mandate is essential to prohibit selective abortion of female fetuses.

Q.89 Internet my friend.
What are the effects of alcohol drinking and smoking on foetus in pregnant women?

Ans :

i. Alcohol in the mother's blood passes to the baby through the umbilical cord.
Drinking alcohol during pregnancy can cause miscarriage, stillbirth, and a range of lifelong physical, behavioral and intellectual disabilities.

ii. The disabilities are known as Fetal Alcohol Spectrum Disorders (FASDs).

iii. **Children with FASDs might have the following characteristics and behaviours:**
Abnormal facial features, such as a smooth ridge between the nose and upper lip, small head size, shorterthan-average height, low body weight, poor coordination, hyperactive behaviour, difficulty with attention, poor memory, difficulty in school (especially with math), learning disabilities, speech and language delays, intellectual disability or low IQ, poor reasoning and judgement skills, sleep and sucking problems as a baby, vision or hearing problems, problems with the heart, kidney or bones.

MULTIPLE CHOICE QUESTIONS

Entrance Set 10 (2.10, 2.11 & 2.12)

1. An oral contraceptive pill checks
(a) Fertilization (b) Implantation
(c) Infection (d) Ovulation

2. The birth control pill contains _____.
(a) Progesterone and estrogen
(b) LH and estrogen
(c) FSH and LH
(d) FSH and estrogen

3. Which of the following is a hormone releasing IUD?
(a) Cu7 (b) LNG - 20
(c) Multiload 375 (d) Lippes loop

4. The function of copper ions in copper releasing IUD's is:
(a) They suppress sperm motility and fertilising capacity of sperms
(b) They inhibit gametogenesis
(c) They make uterus unsuitable for implantation.
(d) They inhibit ovulation.

5. Tubectomy is a method of sterilization in which
(a) small part of the fallopian tube is removed or tied up
(b) ovaries are removed surgically.
(c) small part of vas deferens is removed or tied up
(d) uterus is removed surgically.

6. The sterilization procedure in human female is
(a) Coitus interruptus
(b) Rhythm method
(c) Tubectomy
(d) Vasectomy

7. The technique used to block the passage of sperm in male _____.
(a) Tubectomy
(b) Vasectomy
(c) Coitus interrupts
(d) Rhythm method

8. Which of the following is INCORRECT regarding vasectomy?
(a) Irreversible sterility
(b) No sperm occurs in seminal fluid
(c) No sperm occurs in epididymis
(d) Vasa deferentia is cut and tied

9. Which of the following approaches does not give the defined action of contraceptive?

a.	Hormonal contraceptives	Prevent/retard entry of sperms, prevent ovulatio and fertilisation
b.	Vasectomy	Prevent spermatogenesis
c.	Barrier methods	Prevent fetilisation
d.	Intra uterine devices	Increase phagocytosis of sperms, suppress sperm motility and fetilizing capacity of sperms

10. Select the right option matching column I and column II correctly.

	Column I		Column II
i.	Hormonal pills	a.	Fusion of gametes is prevented
ii.	Spermicides	b.	Vasectomy
iii.	Condoms	c.	Natural method and almost nil side effects
iv.	Sterilization	d.	Inhibit O_2 uptake and kill sperms
v.	Interruption-coitus	e.	Prevents the release of ovum from the

(a) (i-d) (ii-e) (iii-c) (iv-b) (v-a)
(b) (i-e) (ii-b) (iii-a) (iv-d) (v-e)
(c) (i-e) (ii-d) (iii-a) (iv-b) (v-c)
(d) (i-a) (ii-d) (iii-b) (iv-c) (v-e)

11. Match the following column I with column II

	Column I		Column II
i.	Surgical methods	a.	Condom
ii.	Barrier methods	b.	Pills
iii.	Natural methods	c.	Tubectomy
iv.	Chemical methods	d.	Lactational amenorrhea

Select the code for the correct answer from the options given below.
(a) i - c, ii - a, iii - d, iv - b
(b) i - c, ii - d, iii - a, iv - b
(c) i - d, ii - c, iii - b, iv - a
(d) i - b, ii - a, iii - c, iv - d

12. In context of amniocentesis, which of the following statement is INCORRECT?
(a) It can be used for detection of down syndrome
(b) It can be used for detection of Cleft palate
(c) It is usually done when a woman is between 14-16 weeks pregnant
(d) It is used for prenatal sex determination.

13. The following factors indicate improved reproductive health of the society. Choose the correct option.
i. Better detection and cure of disease
ii. Better post-natal care
iii. Medically assisted deliveries
iv. Increased MMR
Select the code for the correct answer from the options given below.
(a) ii, iii and iv only (b) i, ii and iii only
(c) i, iii and iv only (d) i, ii and iv only

14. Contraceptive oral pills used by females help in birth control by
(a) killing of ova
(b) killing of sperms
(c) preventing ovulation
(d) forming barrier between sperms and ova

15. Most important component of oral contraceptive is
(a) LH (b) GH
(c) Thyroxine (d) Progesterone

16. Progesterone present in contraceptive pill is meant for preventing
(a) ovulation
(b) cleavage
(c) fertilization
(d) implantation of zygote

Try yourself

17. A method of birth control is
(a) HTF (b) GIFT
(c) IUDs (d) IVF-ET

18. Most effective contraceptive method for ladies is
(a) ECP (b) MTP
(c) Cu-T (d) Rhythm method

19. Copper-T/loop prevents
(a) cleavage (b) fertilization
(c) ovulation (d) zygote

20. Copper-T:
(a) acts as a barrier
(b) prevents cleavage
(c) suppresses fertilization
(d) prevents implantation of blastocysts

21. Cu ions released from copper-releasing Infra Uterine Devices (IUDs)
(a) make uterus unsuitable for implantation
(b) increase phagocytosis of sperms
(c) suppress sperm motility
(d) prevent ovulation

22. Which one is the safest method of birth control?
(a) The rhythm method
(b) Sterilization techniques
(c) Use of physical barriers

(d) Termination of unwanted pregnancy

23. Tubectomy, a method of population control, is performed on
(a) males only
(b) females only
(c) both males and females
(d) only pregnant females

24. Which is related to males?
(a) Oral pill (b) Tubectomy
(c) Vasectomy (d) None of these

25. Preventive birth control measure is
(a) MTP
(b) Test tube babies
(c) Preventing union of sperm and ovum
(d) Preventing sperms from entering uterus

26. Given below are four methods (A-D) and their mode of action (1-4) in achieving contraception. Select their correct matching from the four options that follow:

Method		Mode of action
The pill	1	Prevents sperm reaching cervix
Condom	2	Prevents implantation
Vasectomy	3	Prevents ovulation
Copper-T	4	Semen contains no sperm

Answer codes
(a) A = 3, B = 1, C = 4, D =2
(b) A = 2, B = 3, C = 1, D = 4
(c) A = 4, B = 1, C = 2, D = 3
(d) A = 3, B = 4, C = 1, D = 2

27. Which of the following methods of birth control is effective, easy to use and inexpensive?
(a) IUD (b) Condom
(c) Implant (d) Diaphragm

28. Which of the following is mechanical barrier used in birth control?
(a) Loop (b) Copper-T
(c) Diaphragm (d) Dalcon shield

29. Which one is not included in barrier methods of birth control?
(a) Diaphragms (b) Lippes loop
(c) Cervical caps (d) Vaults

30. Consider the statements given below regarding contraception and answer as directed thereafter
1. Medical Termination of Pregnancy (MTP) during first trimester is generally safe
2. Generally chances of contraception are nil until mother breast-feeds the infant upto two years
3. Intrauterine devices like copper-T are effective contra-ceptives
4. Contraceptive pills may be taken upto one week after coitus to prevent conception
(a) 1 and 2 (b) 2 and 3
(c) 3 and 4 (d) 1 and 3

2.13 Sexually Transmitted Diseases (STDs)

Q.90 What are STDs

Ans :

i. Diseases or infections which are transmitted through sexual intercourse are collectively called Sexually Transmitted Diseases (STDs) or Venereal Diseases (VDs) or Reproductive Tract Infections (RTI).

ii. The major venereal diseases are syphilis and gonorrhoea.

Q.91 Write a brief note on syphilis.

Ans :

i. In Syphilis the causative agent is *Treponema pallidum (Bacteria)*.

ii. It's incubation period is 3-4 weeks.

iii. It's infection site is mucous membrane in genital, rectal and oral region.

iv. Symptoms of syphilis are primary lesion called **chancre** at the site of infection. Chancre is formed on external genitalia, skin rashes and mild fever, inflamed joints, loss of hair. Paralysis, Degenerative changes occur in the heart and brain.

v. Preventive measures of syphilis are education about sex practices, sex hygiene, avoiding sex with unknown partner or multipartners, using condom during coitus.

vi. Treatment is antibiotic-penicillin.

Q.92. Write a brief note on gonorrhoea.

Ans :

i. In *gonorrhoea causative* agent is *Neisseria gonorrhoeae* (Bacteria).

ii. It's incubation period in male 2 to 14 days and in female 7 to 21 days.

iii. It's infection site is mucous membrane of urino-genital tract, rectum, throat and eye.

iv. Symptoms of gonorrhoea in male are partial blockage of urethra and reproductive ducts, pus from penis, pain and burning sensation during urination, arthritis, etc.
In female, pelvic inflammation of urinary tract, sterility, arthritis, the children born to affected mother suffer from gonococcal opthalmia and gonococcal vulvovaginitis of girls before puberty.

v. Preventive measures are sex hygiene, using condom during coitus, avoiding sex with unknown partner or multipartners.

vi. Treatment is an antibiotic-Cefixime.

Q.93 Give the name of casual organism of syphilis and write its symptoms.

Ans : *Refer Q.91-i , iv.*

INTEXT

Q.94. Try this
IVF centres : Make a list of IVF centres in Maharashtra.

Ans : Some of the IVF centres in Maharashtra that are enrolled by ICMR are as follows:

i. Kamala Polyclinic and Nursing Home, Mumbai.

ii. Shrikande Hospital and Research Center Pvt. Ltd. Nagpur.

iii. Gynaecworld Assited Fetility Unit, Mumbai.

iv. Malpani Infertility Clinic, Mumbai.

v. Morpheus Nashik Fertility Centre, Nashik

vi. Swamini Fertility Center, Dhule.

vii. Ruby Hall IVF and Endoscopy Center, Pune.

viii. Patki Hospital, Kolhapur.

ix. Siddhivinayak Hospital and Test Tube Baby Center, Akola.

Q.95 Always Remember
Jayesh a young, married man of 26 yrs is suffering from T.B. for the last 2 years. He and his wife are desirous of a child but unable to have one, what could be the possible reason? Explain.

Ans : Chronic infection, long isolation and intake of large quantity of drugs leads to sexual dysfunction in men including infertility. Infertility is one of the most common symptoms of genital tuberculosis in both male and females.
However, if Jayesh is not affected by genital T.B., but is suffering from pulmonary T.B., it is most likely that he is facing an adverse effect of the anti-TB treatment.
Anti-TB treatment also has a negative impact on the quality of sperms in the ejaculate. There is a decrease in sperm quantity, decrease in actively motille sperms and morphologically normal sperms.

Q.96 Neeta is 45 years old and the doctor has advised her not to go for such a late pregnancy. She however wants to be the biological mother of a child, without herself getting pregnant, is this possible and how?

Ans : Neeta can opt for surrogacy to have a biological child of her own without getting herself pregnant. Since she is already 45 years of age, a normal pregnancy would be difficult. Hence, the doctor has advised her not to go in for a late pregnancy to avoid any complications with the child or herself. But since she is desirous of biological child she can opt for surrogacy in which her ovum would be fertilized with the sperm and implanted into the surrogate mother who will bring the pregnancy to term.

Entrance Corner Set 13

i. Gonorrhoea, syphilis, genital herpes, chlamydiasis, genital warts, trichomoniasis, hepatitis-B and of course, the most discussed infection in the recent years, HIV leading to AIDS are some of the common STIs.

ii. Absence or less significant symptoms in the early stages of infection and the social stigma attached to the STIs, deter the infected persons from going for timely detection and proper treatment.

iii. STIs are a major threat to a healthy society. Therefore, prevention or early detection and cure of these diseases are given prime consideration under the reproductive health-care programmes. Though all persons are

vulnerable to these infections, their incidences are reported to be very high among persons in the age group of 15-24 years – the age group to which you also belong. There is no reason to panic because prevention is possible.

iv. One could be free of these infections by following the simple principles given below:
   a. Avoid sex with unknown partners/ multiple partners.
   b. Always try to use condoms during coitus.
   c. In case of doubt, one should go to a qualified doctor for early detection and get complete treatment if diagnosed with infection.

MULTIPLE CHOICE QUESTIONS

1. Incubation period of Treponema pallidum is about
   (a) 2 to 14 days (b) 7 to 21 days
   (c) 1 to 2 weeks (d) 3 to 4 weeks

2.14 Infertility

Q.95 Write a note on infertility

Ans :

i. Infertility is defined as the inability to conceive naturally after (one year of) regular unprotected intercourse.

ii. The causes of infertility could be physical, congenital, diseases, immunological or even psychological.

iii. The common physical causes in females are polycystic ovary syndrome (PCOS), hormonal imbalance, endometriosis while in male, it is less sperm count and small size of penis.

Q.96 Write a detailed note on various assisted reproductive technologies (ART).

Ans :

i. **IVF (In Vitro Fertilization):**
   a. It is a process of fertization where an egg is combined with sperm outside the body in a test tube or glass plate to form a zygote under simulated conditions in the laboratory.
   b. The zygote or early embryos (with up to 8 blastomeres) could be then transferred into the fallopian tube for further development.

ii. **ZIFT (Zygote Intrafallopian Transfer):**
   a. ZIFT is an infertility treatment used when there is a blockage in the fallopian tubes which prevents the fertilization of egg by the sperm.
   b. In this method, egg is removed from woman's ovary.
   c. Fertilization of the egg with sperms is brought about outside the body under sterile conditions to form zygote by the process called in vitro fertilization (IVF)
   d. The zygote is then transferred to fallopian tube for further development.

iii. **GIFT (Gamete Intrafallopian Transfer):**
   a. Transfer of an ovum collected from a donor into the fallopian tube of another female who can provide suitable environment for its fertilization and development.
   b. This technique called gamete intrafallopian transfer (GIFT) has been developed for the cases in which only the entrance to the oviducts or the upper segment of the oviducts in blocked.
   c. In this procedure ova and sperms are directly injected into regions of the oviduct, where fertilization produces a blastocyst, which enters the uterus via the normal route. GIFT has a success rate of about 30 percent.

iv. **ICSI (Intra Cytoplasmic Sperm Injection):**
   a. ICSI is an in vitro fertilization procedure in which a single sperm cell is injected directly into cytoplasm of an ovum in the laboratory.
   b. Here the sperm has to naturally penetrate the egg.

v. **Artificial Insemination (AI):**
   a. In some infertility cases, the male partner is unable to inseminate the female due to a very low sperm count.
   b. This problem can be solved by artificial insemination.
   c. In this technique, the sperms are collected

from the male and artificially introduced into the cervix of female, for the purpose of achieving a pregnancy through in vivo fertilization (inside the body).

vi. **IUI (Intra Uterine Insemination):** In this technique the process is somewhat like that of artificial insemination, the only difference is that the sperms are introduced into the uterine cavity instead of cervix.

TEXTUAL

★Q.97 Write a note on IVF

Ans : Refer Q.96(i)

Q.98 Explain sperm bank.

Ans :

i. A sperm bank or semen bank is a place which collects, stores and provides human sperms / semen.

ii. The semen is provided by healthy males called sperm donors.

iii. The sperms are stored in sperm bank by cryopreservation method (at low temperature).

Q.99 Write a brief note on Adoption.

Ans :

i. Adoption is a legal process by which a couple or a single parent gets legal rights, privileges and responsibilities that are associated to a biological child for the upbringing of the adopted child.

ii. An adoptive parent should be medically fit and financially able to take care of the adopted child.

iii. A person wishing to adopt a child must be at least 21 years old but there is no legal upper age limit for adoption.

TEXTUAL

★Q.100 Fill in the blanks:

i. The primary sex organ in human male is _____.

ii. The _____ is also called the womb.

iii. Sperm fertilizes ovum in the _____ of fallopian tube.

iv. The disc like structure which helps in the transfer of substances to and from the foetus's body is called _____.

v. Gonorrhoea is caused by _____ bacteria.

vi. The hormone produced by the testis is _____.

Ans :

i. testis ii. uterus
iii. ampulla iv. placenta
v. *Neisseria gonorrhoeae*
vi. testosterone.

MULTIPLE CHOICE QUESTIONS

1. Assisted reproductive technology, IVF involves transfer of
   (a) Ovum into the fallopian tube
   (b) Zygote into the fallopian tube
   (c) Zygote into the uterus
   (d) Embryo with 16 blastomeres into the fallopian tube

2. Embryo with more than 16 blastomeres formed due to in vitro fertilisation is transferred into
   (a) cervix (b) uterus
   (c) fallopian tube (d) fimbriae

3. Assisted Reproductive Technology does not include
   (a) Zygote extra fallopian transfer
   (b) In vitro fertilization and Embryo transfer
   (c) Artificial insemination
   (d) Gamete intra fallopian transfer

4. In case of a couple where the male is having a very low sperm count, which technique will be suitable for fertilisation?
   (a) Intrauterine transfer
   (b) Gamete intracytoplasmic fallopian transfer
   (c) Artificial Insemination
   (d) Intracytoplasmic sperm injection.

5. A childless couple visit Assisted Reproductive Technologies (ARTs) centre to get assistance to have a child. On diagnosis, it was noticed that there was low sperm count in the male partner. Which of the following strategy of ART is most suitable in this case?
   (a) Gamete Intra-Fallopian Transfer
   (b) Artificial Insemination (AI)
   (c) Zygote Intra-Fallopian Transfer
   (d) In vitro fertilization (IVF)

❑❑❑

ANSWER KEY

Entrance Corner Set-1

1. (b) 2. (d) 3. (b) 4. (a) 5. (d)
6. (b) 7. (b) 8. (a)

Solution:

1-(b) Both sexual and asexual type of reproduction are found in *Hydra.*

3-(b) Arrhenotoky is a type of parthenogenesis, in which the unfertilized eggs develop into males with haploid cells.

4-(a) Parthenogenesis can be classified into arrhenotoky and thelytoky.

7-(b) Asexual reproduction occurs in a single individual with out production of gametes (in lower animals).

Entrance Corner Set-2

2.2

1. (c) 2. (a) 3. (b) 4. (d) 5. (a)
6. (c) 7. (b) 8. (b) 9. (b) 10. (c)
11. (c) 12. (a) 13. (b) 14. (d) 15. (a)
16. (c) 17. (d) 18. (a) 19. (c) 20. (a)
21. (b) 22. (b) 23. (a) 24. (d) 25. (a)
26. (b) 27. (b) 28. (d) 29. (d) 30. (d)
31. (a) 32. (a)

Solution:

3-(b) Corpus luteum secretes steroid hormones progesterone and estrogen, to make uterus suitable for implantation (in case fertilisation occurs) and its maintenance (mainly endometrium).

4-(d) Interstitial cells or Leydig cells are the cells interspersed between the seminiferous tubules of the testis. They secrete androgens (e.g., testosterone) in response to stimulation by luteinizing hormone from the anterior pituitary gland.

5-(a) The male sex accessory ducts include rete testis, vasa efferentia, epididymis and vas deferens. The seminiferous tubules of the testis open into the vasa efferentia through rete testis. The vasa efferentia leave the testis and open into epididymis located along the posterior surface of each testis. So if vasa efferentia gets blocked, the gametes will not be transported from testes to epididymis.

6-(c) Sertoli cells (named after Italian histologist Enrico Sertoli) are found in the walls of the seminiferous tubules of the testis. Compared with the germ cells they appear large and pale. They anchor and probably nourish the developing germ cells, especially the spermatids, which become partly embedded within them.

7-(b) The seminiferous tubules are closed at one end but on the other side they join to a network the rete testis from where fine ciliated ductules, the vasa efferentia arise. Cilia help-in conducting sperms. The rete testis is a network of tubules conducting sperm from the seminiferous tubules of the testis to the vasa efferentia.

8-(b) Each Fallopian tube is about 10-12 cm long and extends form the periphery of each ovary to the uterus, the part closer to the ovary is the funnel-shaped infundibulum. The edges of the infundibulum possess finger-like projections called fimbriae, which help in collection of the ovum after ovulation. The infundibulum leads to a wider part of the oviduct called ampulla. The last part of the oviduct, isthmus has a narrow lumen and it joins the uterus.

9-(b) In mammals the testis are located in the extra abdominal scrotal sac. But non descent of testes in scrotum is called cryptorchidism. Person becomes sterile.

10-(c) Each testis of man contains about 750 convoluted seminiferous tubules which give rise to spermatozoa.

11-(d) Each seminiferous tubules is lined by a germinal epithelium formed of two types of cell germ or spermetogenic cells and sertoli or nurse cells. Sertoli cells are a few pyramidal shaped cells which provide nutrition to developing sperms.

12-(b) Cells of leydig or interstitial cells are stimulated to secrete male hormone testosterone by the interstitial cell stimulating hormone (ICSH) from anterior lobe of pituitary gland.

13-(a) Each testes is externally covered by a white fibrous capsule the tunica albuginea which is produced inside the testis as fibrous septa.

15-(b) Testes are located in the extra-abdominal scrotal sacs and ovary remains attached to the abdominal wall by a ligament (mesovarium). Both are ventral to kidney.

16-(c) Action of clotting enzyme (of prostate) over fibrinogen (of seminal vesicles) changes the semen into a coagulum in vagina.

Set 2.3

1.	(b)	2.	(b)	3.	(c)	4.	(d)	5.	(c)
6.	(b)	7.	(b)	8.	(b)	9.	(b)	10.	(c)
11.	(b)	12.	(a)	13.	(c)	14.	(d)	15.	(a)
16.	(a)	17.	(a)	18.	(a)	19.	(b)	20.	(b)
21.	(d)	22.	(a)	23.	(b)				

Solution:

1-(b) Corpus luteum literally yellow body. The luteal cells secrete small amounts of estradiol hormone and significant amounts of the progesterone hormone. Corpus luteum also secretes relaxin hormone.

2-(b) Graafian follicle develops under influence of FSH of anterior pituitary. Its follicular cells secrete estrogen. Rising level of estrogen decreases production of FSH and stimulates secretion of LH. The two cause the mature graafian follicle to rise to the ovarian surface and burst open releasing ovum.

6-(b) The ruptured follicle show proliferation of cells of membrana grenulosa, deposition of yellow pigment or lutein and formation of yellow body called corpus luteum. Corpus luteum secretes progesterone. Ultimately corpus luteum loses its yellow colour becomes changed to corpus albicans and then degenerated.

9-(b) Cervix is lower narrow part which opens in body of uterus by internal os and in vegina below by external os.

17-(a) Seminal fluid has a pH about 7.4 and contains fructose, citrate, ascorbic acid prostaglandins and various enzymes. The fructose is a source of energy for the spermatazoa.

18-(a) The greater vestibular glands (Bartholin's glands) are paired glands situated one on each side of the veginal opening. These glands are homologous to the bulbourethral (cowper's) gland of male and secrete viscid fluid that supplements lubrication during sexual inter course.

19-(b) Seminal vesicles (uterus masculinus) are situated behind the bladder at the function of vas deferens and prostate gland. They are narrow long pouches with muscular tissue on their wall.

21-(b) Regner de graaf (1641-1673) discovered follicles in human ovary is 1671 and considered them to be eggs. Since graaf discovered follicles. They are also called graffian follicles.

23-(d) Cortex contains many small and large spherical or oval ovarian follicles. A fully matured follicle is called graafian follicle.

24-(a) Human egg or ovum is non cleidoic and alecithal. The ovum possesses three coverings-Inner plasma membrane, middle glycoprotein zona pellucida and outer cellular corona radiata with radially elongated scattered cells held in mucopolysaccharide.

Set 2.3

1.	(b)	2.	(d)	3.	(a)	4.	(a)	5.	(b)
6.	(d)	7.	(c)	8.	(d)	9.	(d)	10.	(c)
11.	(c)	12.	(c)	13.	(a)				

Solution:

8-(d) The fusion of a haploid male gamete (sperm) and a haploid female gamete (ovum) to form a diploid zygote is called fertilisation. In human beings, it takes place in the ampullary isthmic junction of the oviduct (Fallopian tube).

10-(c) In human females, ovulation is the release of secondary oocyte from the ovary at about 14th day of the menstrual cycle. Both LH and FSH attain a peak level during this period. Rapid secretion of LH induces rupturing fo fully developed Graafian follicle and thereby release of ovum. LH surge is actually responsible for ovulation.

11-(c) The corpus luteum secretes large amounts of progesterone which is essential for maintenance of the endometrium necessary

for implantation of the fertilized ovum and other events of pregnancy. In the absence of fertilization, the corpus luteum degenerates. This causes disintegration of the endometrium leading to menstruation. The menstrual flow results due to breakdown of endometrial lining of the uterus and its blood vessels which forms liquid that comes out through vagina.

12-(c) After ovulation which occurs in the middle of menstrual cycle, empty Graafian follicle continues growth under the influence of LH. The follicular cells are converted into lutein cells by deposition of yellowish lipid inclusions. The phenomenon is called luteinization. The ruptured Graafian follicle is now called corpus luteum. It secretes hormones,mainly progesterone help in further growth and thickening of endometrium. The major change is that the endometrial glands become secretory. The uterine wall becomes ready for nourishing and anchoring blastocyst if fertilization takes place. Hence, this phase of menstrual cycle is called luteal or secretory phase. The phase lasts for about 13 days, i.e., 15-28 days of 28 days menstrual cycle.

13-(a) Both LH and FSH attain a peak level in the middle of menstrual cycle (about 14^{th} day). Rapid secretion of LH leading to its maximum level during the mid-cycle called LH surge induces rupture of Graafian follicle and thereby the release of ovum (ovulation).

Set 2.4

1.	(b)	2.	(b)	3.	(c)	4.	(c)	5.	(b)
6.	(a)	7.	(d)	8.	(a)	9.	(c)	10.	(a)
11.	(d)	12.	(a)	13.	(b)	14.	(a)	15.	(b)

Solution:

11-(d) Formation of spermatozoa from spermatids is called spermiogenesis.After spermiogenesis, sperm heads become embedded in the Sertoli cells and ar finally released from the seminiferous tubules by the process called spermiation.

12-(a) Spermatogonia are diploid cells which mature into primary spermatocytes (2n) by growth. They then produce two haploid secondary spermatocytes by meiosis I. Each secondary spermatocyte (n) completes the meiosis II and produces two spermatids (n). Each spermatid (n) develops into a spermatozoan or sperm (n). Each spermatid (n) develops into a spermatozoan or sperm (n). Similarly, in females, oogonia are the diploid cells from which through meiosis, polar bodies (n) are produced.

13-(b) Spermatogenesis is the process of formation of haploid spermatozoa (sperms) form diploid spermatogonia inside the testes of the male. At sexual maturity, the undifferentiated primordial germ cells divide several times by mitosis to produce a large number of spermatogonia or sperm mother cells. Each spermatogonnium actively grows to a larger primary spermatocyte by obtaining nourishment from the nursing cells. The phenomenon of formation of primary spermatocytogenesis. Each primary spermatocyte undergoes two successive divisions, called maturation divisions. The first maturation division is reductional or meiotic. Hence, the primary spermatocyte divides into two haploid daughter cells called secondary spermatocytes. Both secondary spermatocytes now undergo second maturation divison which is an ordinary mitotic division to form four haploid spermatids, by each primary spermatocyte. The tranformation of spermatids into spermatozoa is called spermigogenesis or spermateleosis or differentiation phase.

14-(a) Sperms remain viable for 48 hours to 72 hours.

15-(b) Acrosome is the cap-like structure on the front end of a spermatozoan. It breaks down just before fertilisation (the acrosome reaction), releasing a number of hydrolytic enzymes, also called sperm lysins that assist penetration between the follicle cells that still surround the ovum, thus facilitating fertilisation. Failure of the acrosome reaction is a cause of male infertility.

Set 2.5

1. (d) 2. (a) 3. (a) 4. (d) 5. (d)
6. (a) 7. (b) 8. (d) 9. (d) 10. (d)
11. (a)

Solution:

7-(b) Entry of sperm into the secondary oocyte induces the completion of the meiotic division of the secondary oocyte. The second meiotic division is unequal and results in the formation of a second polar body and a haploid ovum (ootid). Soon the haploid nucleus of the sperms and that of the ovum fuse together to form a diploid zygote.

8-(d) The fusion of a haploid male gamete (sperm) and a haploid female gamete (ovum) to form a diploid zygote is called fertilisation. In human beings, it takes place in the ampullary isthmic junction of the oviduct (Fallopian tube).

9-(d) In human beings, ovum is released from the ovary in the secondary oocyte stage. The maturation of secondary oocyte is completed in the mother's oviduct(Fallopian tube) usually after the sperm has entered the secondary oocyte for fertilisation. Entry of the sperm restarts the cell cycle breaking down MPF (M-phase promoting factor) and turning on APC (Anaphase converts the secondary oocyte into a fertilised ovum (egg) or zygote (and also a second polar body).

10-(d) Ectopic pregnancy is a complication of pregnancy in which implanation of embryo takes place at site other than uterus. Signs and symptoms include abdominal pain and vaginal bleeding. Most ectopic pregnancies (90%) occur in the Fallopian tube, which are known as tubal pregnancies.

11-(a) The process of fusion of a sperm with an ovum is called fertilizaion. During fertilization, a sperm comes in contact with the zona pellucida layer of the ovum and induces changes in the membrane that block the entry of additional sperms.Thus, it ensures that only one sperm can fertilize an ovum. The secretions of the acrosome help the sperm enter into the cytoplasm of the ovum through the zona pellucida and the plasma membrane. In contact with the surface of egg covering, the acrosome releases its contained hydroyltic enzymes, also called sperm lysins. It is known as acrosomal reaciton results in dissolving of corona cells and degeneration of zona pellucide which helps in sperm penetration.

Set 2.6

1. (b) 2. (a) 3. (d) 4. (c) 5. (c)
6. (c) 7. (d) 8. (d) 9. (a) 10. (c)
11. (a)

Solution:

10-(c) After fertilization, zygote undergoes rapid mitotic divisions, called cleavage, which is characterized by absence of growth of daughter cells. This leads to the conversion of single celled zygote into a multicellular sturcture called blastocyst or blastula. Implantation or embedding of zygote stage. The various stages in the journey of a fertilized egg from fertilization in the Fallopian tube to the implantation site in the uterus is illustrated in the given figure. (dig.)

Blastocyst comes in contact with the endometrium in the region of embryonal knob or embryonic disc. It adheres to the same. The surface cells of trophoblast secrete lytic enzymes which cause corrosion of endometrial lining. They also give rise to finger like outgrowths called chorionic villi. Chorionic villi and uterine tissue become interdigitated. Villi not only help in fixation but also helps in absorption of nourishment.

11-(a) A morula is an embryo at an early stage of embryonic development, consisting of cells (called blastomeres) in a solid ball contained within the zona pellucida. The morula is produced by embryonic cleavage, the rpaid division of the zygote. The increase in number of cells does not change the size of the original mass. The divisions are rapid because there is no net growth of the embryo-the cell cycle alternates between DNA replication and mitosis. In the absence of growth, the cell number in the embryo increases while the cell size decreases. Thus, it has almost equal

quantity of cytoplasm as an uncleaved zygote but much more DNA.

Set 2.7

1. (c) 2. (c) 3. (b) 4. (b) 5. (b)
6. (b) 7. (c) 8. (d) 9. (c) 10. (c)

Solution:

3-(b) In human beings, after one month of pregnancy, the embryo's heart is formed. By the end of the second month of pregnancy, the fetus develops limbs and digits. By the end of 12 weeks (first trimester), most of the major organ systmes are formed. The first movements of the fetus and appearance of hair on the head are usually observed during the fifth month. By the end of 24 weeks (second trimester), the body is covered with fine hair, eye-lids separate and eyelashes are formed. By the end of nine months of pregnancy, the fetus is fully developed and is ready for delivery.

5-(b) The original function of the allantois as a urinary bladder becomes altogether lost.

6-(b) Trophoectoderm form placenta which help to draw food for the developing cells

7-(c) Extra embryonic membranes (foetal membranes) are concerned with protection, respiration, excretion, and nutrition of developing embryo.

8-(d) Amnion provides a kinds of private aquarium to the embryo and protects it from mechanical shock and desiccation.

9-(c) Peripheral cells of morula become the trophoblast (trophoectoderm) cells which later produce the four extra embryonic membranes.

10-(c) Man has four foetal membranes viz-Amnion, Chorion, Allantois and yolk sac.

Set 2.8

1. (d) 2. (a) 3. (c) 4. (d) 5. (c)
6. (c) 7. (c) 8. (b) 9. (b) 10. (b)
11. (c) 12. (d) 13. (d) 14. (b) 15. (c)
16. (d) 17. (d)

Solution:

7-(c) Placenta is temporary organ that helps in exchange of gases, nutrients and waste materials between mother and fetus. During pregnancy, placenta acts as an endocrine gland and secretes some hormones sucha s estrogen, progesterone, human placental lactogen (hPL), chorionic thryrotropin, chorionic corticotropin and relaxin.

8-(b) Placenta is temporary organ that helps in exchange of gases, nutrients and waste materials between mother and fetus. During pregnancy, placenta acts as an endocrine gland and secretes some hormones sucha s estrogen, progesterone, human placental lactogen (hPL), chorionic thryrotropin, chorionic corticotropin and relaxin.

9-(b) Parturition is induced by a complex neuroendocrine mechanism. The signals for parturition originate form the fully developed fetus and the placenta which induce mild uterine contractions called fetal ejection reflex. This triggers release of oxytocin from the maternal pituitary. Oxytocin acts on the uternie muscle and causes stronger uterine contractions, which in turn stimulates further secretion of oxytocin. The stimulatory reflex between the uterine contraction and oxytocin secretion continues resulting in stronger and stronger contractions. This lead to expulsion of the baby out of the uterus through the birth canal.

11-(c) Placenta is universally present in eutherian mammals.

13-(d) Placenta is formed from allantois and chorion e.g., Eutherian mammals (Rabbits)

15-(c) Word endometrium is composed of *endo* and *metra* which in Greek language means within and uterus respectively *i.e.*, within uterus. Endometrium is the glandular lining of the uterus in mammals. It thickens in response to progesterone secretion during ovulation and is sloughed off in menstruation.

16-(d) In human placental villi remain restricted to a small disc – shaped area (discoidal) attached to the utrine wall.

Set 2.9

1. (d) 2. (b) 3. (c) 4. (d) 5. (b)
6. (b) 7. (d) 8. (a) 9. (b) 10. (d)
11. (d) 12. (b) 13. (a) 14. (a) 15. (d)
16. (c)

Solution:

6-(b) Process of parturition is induced by both nervous system and hormones secreted by the endocrine glands of the mother. The signals for child birth (parturition) originate form the fully developed fetus and placenta which induce mild uterine contractions called fetal ejection reflex. This causes quick release of oxytocin from the maternal posterior lobe of pituitary gland which induces labour pains. Prostoglandins, progesterone and estrogen also play a role. Prolactin is the hormone which induces lactation and has no role in parturition.

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10-(d) About 669 days.

11-(d) Mouse has a gestation period of about 19–20 days.

16-(c) Gestation period is the duration between fertilization and parturition.

Set 2.10 (2.10, 2.11, 2,12)

1.	(d)	2.	(a)	3.	(b)	4.	(a)	5.	(a)
6.	(c)	7.	(b)	8.	(c)	9.	(b)	10.	(c)
11.	(a)	12.	(b)	13.	(b)	14.	(c)	15.	(d)
16.	(a)	17.	(c)	18.	(c)	19.	(b)	20.	(c)
21.	(c)	22.	(b)	23.	(b)	24.	(c)	25.	(c)
26.	(a)	27.	(b)	28.	(c)	29.	(b)	30.	(d)

Set 2.13

1. (d)

Set 2.14

1.	(b)	2.	(b)	3.	(a)	4.	(c)	5.	(b)