EDUCATALYSTS

Class(12th)

Introduction to Human Reproduction

| INTRODUCTION

Reproduction: Reproduction means the ability to produce individuals of the same species.

Reproductive events in humans

(i) Gametogenesis: Formation of gametes, i.c., sperms in male and ovum in female.

(ii) Insemination: Transfer of sperms into the female genital Iracl.

(iii) Fertilisation: Fusion of male and female gametes leading to the formation of zygote.

(iv) Implantation: Attachment of blastocyst to the uterine wall for nourishment.

(v) Gestation: Embryonic development.

(vi) Parturition: Delivery of the baby. | REPRODUCTIVE SYSTEM

◎ To continue its own rucc, an organism prixluces oflsprings like its own by the process of reproduction.

© The Ibrmadon of gametes takes place in the reproductive organs.

Primary sex organs:

◎ Lssential organs which are responsible tor the formation of (he gametes (sperm and eg^*) and hormone production.

© The male gamete is the spermatozoan.

◎ The lemalc gamete is the ovum.

-KEYNOTE - Primary sex organs arc generally known as gonads because they produce reproductive gametes containing heritable DNA.

Secondary sex organs:

Q Tlicy arc imporlanl lor reproduaion but do not produce gametes.

◎ These form the passage for the gametes to help the union of male and female gametes.

Development of Sex organ:

® During intra uterine life (IUL) testis and ovary develop from mesoderm. They develop in abdominal cavity in IUL, at the time of birth, testes descend down into scrotal sac under the influence of testosterone but ovaries remain in abdominal cavity.

| MALE REPRODUCTIVE SYSTEM

◎ The male reproductive system is located in the pelvis region.

© It includes a pair of lestes. accessory glands, a duel system and penis.

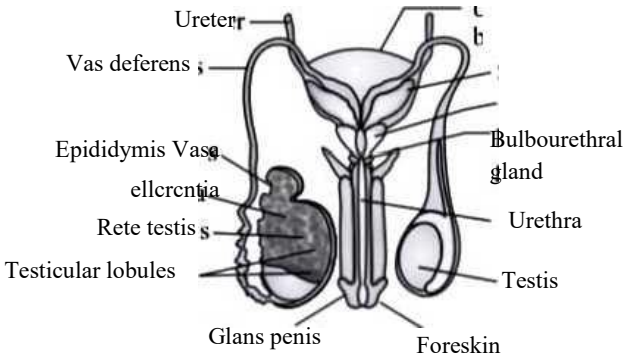


Fig.: Diagrammatic view of male reproductive system

Testes

◎ Testes arc the primary male sex organs.

◎ Testis produces spermatozoa and secretes the male sex hormone, i.c.. testosterone.

O In mammals, (he testes arc located outside the abdominal cavity within a pouch called scrotum. *-KEYNOTE* - The temperature in scrotum is *2* to 2.5°C below the temperature of abdominal cavity because maturation of sperm needs low tcmpcraiurc.

◎ Scrotum is connected to (he abdominal eavity through inguinal canal.

◎ Testis is connected to the dorsal abdominul wall by a spermatic cord consisting of connective tissue, spermatic artery, spcmiatic nerve▪ etc.

Need To Know:

♦ Gubernaculum is the ligamentous connective cord (elastic cord) which connects testes to scrotal sacs posteriorly.

♦ In bats, rats and otter, testes descend to scrotal sacs only during breeding season.

♦ Whales and elephants have abdominal testes. Their body temperature is low and cooling of testes is not required.

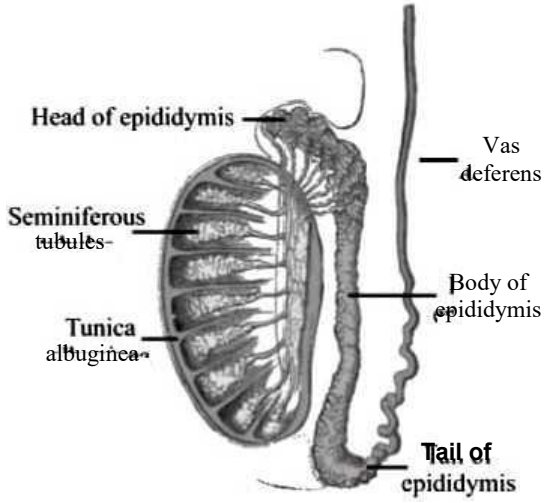
♦ Orchidectomy is the surgical removal of testes. It is also known as castration.

© The capsule enclosing (estes of mammal is called tunica albuginea.

◎ In adults, each testis is oval in shape, with a length of about 4 to 5cm and a width of uboul 2 to 3cm.

◎ Each teslis has about 250 compartments called testicular lobules.

◎ Each lobule contains one to three highly coiled seminiferous tubules in which sperms arc produced.



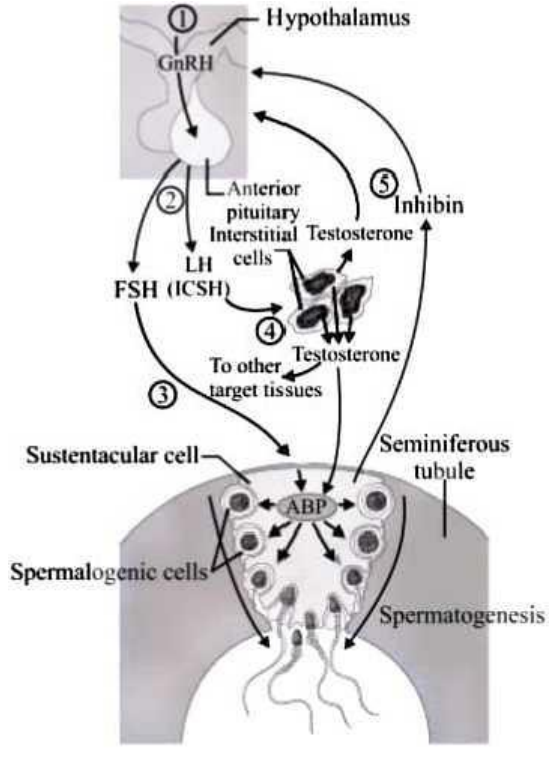
◎ The germinal epithelium lining of the seminiferous tubule is made of two kinds of cells; male germ cells (spermatogonia) and sertoli cells.

◎ The spermatogonia undergo spermatogenesis to produce spcims.

© Sertoli cells/sustentacular cells (supporting cells) arc located in seminiferous tubules which nourish spermatozoa.

© Interstitial space arc the regions outside the seminiferous tubules which contain small blood vessels, interstitial cells and immunocompetent cells..

◎ Interstitial cells or Leydig cells arc found in interstitial connective tissue of testes. They synthesise and secrete testicular hormones called androgens.



◎ All the seminiferous tubules in each testis open into a network called retc testis Icadinp to fine ductules called vasa effcrcntia

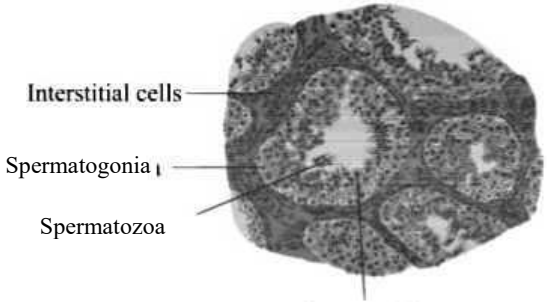


Fig.: Diagrammatic sectional view of seminiferous tubule

Epididymis

© Several ducts called vasa eflerentia arise from rctc testis and open into epididymis.

◎ Epididymis is an irregular, narrow and highly convoluted tubule located along tlic posterior surface of each testis.

◎ Epididymis has 3 parts:

(i) Upper, highly coiled part - Caput epididymis or Globus major

(ii) Middle part - Corpus epididymis

(iii) Basal, least coiled pari - Cauda epididymis or Globus minor

-KEYNOTE ~

- Sperms achieve maturity and motility in epididymis.
- ♦ Epididymis can temporarily stores the sperms.

Vas Deferens

© Vas deferens or sperm duct arises from cauda epididymis, ascends to abdomen, loops over the urinary bladder and receive a duct from seminal vesicle and opens into urethra as ejaculatory duct.

-KEYNOTE —

Ejaculatory ducts store and transport the sperms from the testis to the outside tlirough urethra.

Urethra

◎ Urethra is a thick-walled muscular duct and it is a common passage for both urine and semen and called urinogcnital duct.

◎ The urethra originates from the urinary bladder and extends through the penis to its external opening called urethral meatus.

Penis

◎ The penis is the male external genitalia.

◎ It is made up of special tissue that helps in erection of the penis to facilitate insemination.

◎ The enlarged end of penis called the glans penis is covered by a told of skin called foreskin

Male Accessory glands

Seminal vesicles

◎ Seminal vesicles arc situated at the junction of vas deferens and prostate gland. They arc narrow, long pouches with muscular tissue on their wall.

Q About 70% of the semen is seminal fluid which is produced by seminal vesicles.

© Seminal Fluid : Seminal fluid has a pH of about 7.4 and is rich in fructose, ascorbic acid, prostaglandins and various enzymes.

-KEYNOTE ~

The fructose, present in the seminal fluid, is a source of energy for the spermatozoa.

Prostate Gland

© Prostate is situated at the origin of the urethra. It contains prostatic fluid (slightly acidic) and covered by a capsule. **® Prostalic Fluid:** Prostatic secretion forms about 20% of the volume of semen.

◎ It **is slightly acidic.** pH 6.5 due Io the presence of citric acid. *Q)* Prostatic secretion contains substances important for sperms mobility.

◎ The secretions involve albumin, calcium ions and proteolytic enzymes fibrinolysin and fibrinogcnasc.

Cowper's glands

® These arc also known as bulbourethral glands, situated beneath bladder and behind the urethra.

◎ Cowper's glands open into urethra before entering into penis. ©

Cowper's Fluid: Secretion of cowper's gland is **slightly alkaline** and is produced during sexual stimulation.

-KEYNOTE -

Cowper's gland secretion acts as a lubricant for the glans penis. It also neutralises any urine in urethra.

| Female Reproductive System

◎ Female reproductive system consists of a pair of ovaries, oviducts (fallopian tubes), uterus, cervix, vagina, accessory genital glands, mammary glands, etc.

◎ These parts of the system along with a pair of the **mammary glands** arc integrated structurally and functianally to support the processes of ovulation, fertilisation, pregnancy, birth and child care.

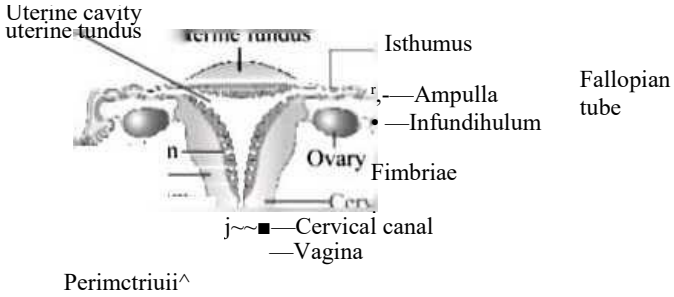


Fig.: Diagrammatic sectional view of the female reproductive system

Ovary

© The ovary is the primary female sex organ.

◎ Ovary produces the female gamete (ova) and secretes female sex hormones viz., estrogens and progesterone.

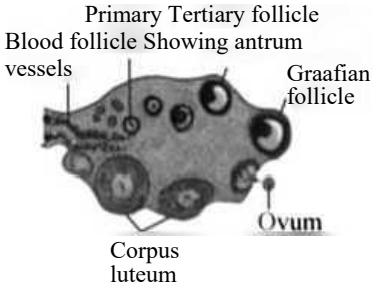


Fig.: Diagrammatic sectional view of ovary ◎ The ovaries arc located one on each side of the lower abdomen.

◎ The ovary remains attached to the abdominal wall by a ligament called **mesovarium.**

0 Each ovary is about 2 to 4 cm in length and is connected to the pelvic wall and uterus by ligaments.

© Ovary is covered by a thin epithelium called the germinal epithelium which encloses the ovarian stroma.

◎ Stroma composed of an outer (peripheral) dense layer called **cortex** and an inner loose layer known as **medulla.**

Oviducts (fallopian tubes)

◎ Each fallopian tube is about 10-12 cm long and extends from 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.

◎ The wall of oviducts is highly muscular and lined by simple columnar ciliated epithelium which helps in movement of ova.

Vagina

◎ Uterus opens into an clastic muscular tube called vagina.

© The vagina is lined by a nonkcratiniscd stratified squamous epithelium without any glands.

-*KEYNOTE* ~

During reproductive lite, the vagina contains *Lactohacilhis acidophilus* which keeps the vaginal pll between 4.9 and 3.5 by producing lactic acid from glycogen.

◎ Bartholin's gland: On citlicr side of vaginal orifice, a vestibular gland or Bartholin's gland is present.

© Bartholin's gland occurs in icmale mammals and helps in vestibular lubrication.

-*KEYNOTE* ~ Bartholin's gland of female corresponds to bulbourclhal gland (Cowper's gland) of the male.

Fig.: Diagrammatic sectional view of female pelvis showing

reproductive system

Uterus

◎ The ulcrus is single and it is also called womb.

© The shape of the uterus is like an inverted pear. It is supported by ligaments attached to the pelvic wall. The uterus opens into vagina through a narrow cervix.

◎ The cavity of the cervix is called cervical canal which along with vagina forms the binh canal.

© The cervical glands secrete ccrx ical mucus.

◎ The wall of the uterus has myometrium three layers of tissue:

(i) Perimetrium: External thin membranous

(ii) Myometrium: Middle thick layer of smooth muscle.

(iii) Endometrium: Inner glandular layer that lines (he uterine cavity.

-*KEYNOTE* - The endometrium undergoes cyclical changes during menstrual cycle while the myometrium exhibits strong contraction during delivery of the baby. **Female external genita|la**

◎ The female external genitalia include mons pubis, labia majora. labia minora, hymen and clitoris.

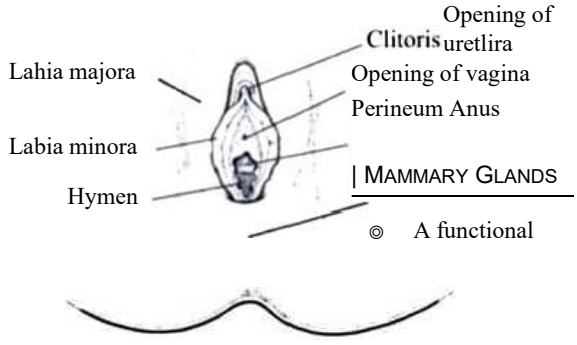
(i) Mons pubis: A cushion of tally tissue covered by skin and pubie hair.

(ii) Labia majora: Fleshy folds of tissue, which extend down from the mons pubis and surround the vaginal opening.

(iii) Labia minora: Paired folds of tissue under the lahia majora.

(iv) llymen: The opening of (he vagina is often covered partially by a membrane. The hymen is often tom during the first coitus (intercourse).

(v) Clitoris: A tiny finger-like structure which lies at the upper junction of the two labia minora above the urethral opening.



| MAMMARY GLANDS

◎ A functional mammary gland is characteristic of all female mammals.

◎ The mammary glands arc paired structures (breasts) that contain glandular tissue and variable amount of iat.

© The glandular tissue of each breast is divided into 15-20 mammary lobes containing clusters of cells called alveoli

◎ The cells of alveoli secrete milk, which is stored in (he cavities (lumens) of alveoli.

◎ The alveoli open into mammary tubules.

◎ The tuhules of each lobe join to form a mammary duct.

◎ Several mammary ducts join to fonn a wider mammary umpulla which is connected to lactiferous duct through which milk is sucked out.

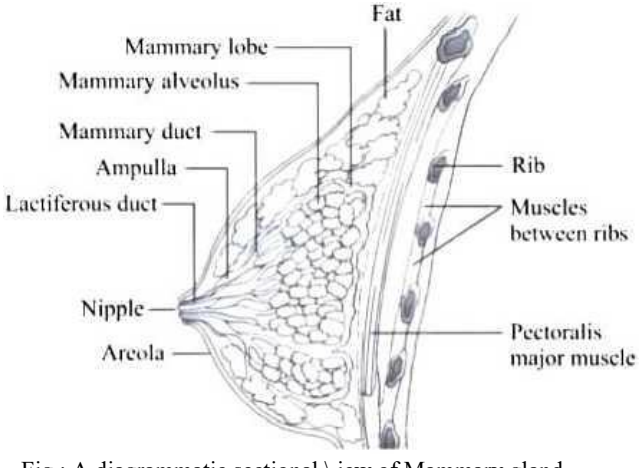


Fig.: A diagrammatic sectional \ iew of Mammary gland

Table: Primary and Secondary sex organs in male and female

Sc\	Prim an Sex Organ	Secondary Sex Organ	Accessory or external Sex character
Male	Testis	Prostate. seminal vesicle, vas deferens, epididymis, penis	Low - pitch voice, heard, broad shoulder, narrow hips
Female	Ovary	Fallopian tubes, uterus, vagina, mammary glands	High • pitch voice, smooth face. narrow shoulder. broad hips

| HORMONAL CONTROL OF FEMALE REPRODUCTIVE SYSTEM

◎ Ovary is regulated by pituitary gonadotropins or GnRll.

◎ Anterior pituitary secretes follicle stimulating hormone (FSH) which controls the transformation of young primary follicle into Graafian follicle, maturation of ovum and secretion of estrogens by its follicular cells.

◎ The Luteinizing hormone (LH) of anterior pituitary reguhtes tl)c ovulation from the Graafian follicle, transfomiation of empty Graafian tollicle into yellowish, conical coipus lutcum and secretion of progesterone hormone from the corpus lutcum.

◎ Growth and fijnetion of sccondajy sex organs arc regulated by estrogen and progesterone.

© Estrogen controls the growth, nuintcnancc and functioning of secondary sex organs of female.

◎ Progesterone suspends ovulation during pregnancy, promotes implantation of foetus on the endometrium and development of foetus in the uterus.

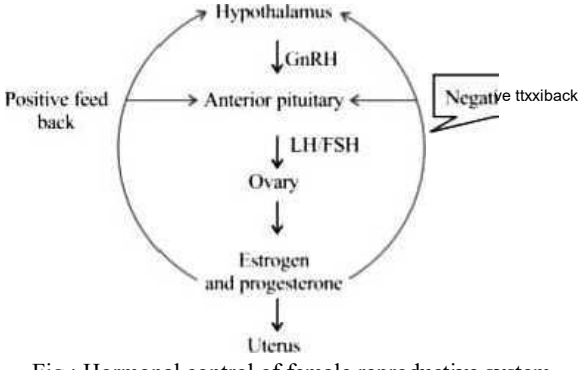


Fig.: Hormonal control of female reproductive system

◎ At the end of pregnancy, the corpus lutcum secretes relaxin which broadens the pelvis for easy parturition.

I GAMETOGENESIS

◎ Gametogenesis is the process of gamete (sperm or egg) formation.

◎ It include spermatogenesis and oogenesis.

Spermatogenesis

© Spcmiatogcncsis results in the formation of sperms that arc transported bv the male sex accessory ducts.

◎ Spermatogenesis is a continuous process and occurs in seminiferous tubules at the time of puberty (due to significant increase in the secretion ofGnRH) and continues throughout life. O Increased levels of GnRII acts at the anterior pituitary gland and stimulates secretion of luteinizing hormone (LH) and follicle stimulating hormone (FSH). LH act at the Leydig cells and stimulates synthesis and secretion of androgens. Androgens, in turn, stimulate the process of spermatogenesis. FSH act on the Sertoli cells and stimulates secretion of some

factors which help in the process of spcrmiogcncsis.

© The spermatogonia present on the inner wall of seminiferous tubules multiply by mitotic division and increase in numbers. Lach spermatogonium is diploid and contains 46 chromoKomesi. Some of the jspermatogonia called primary spermatocytes periodically undergo mciosis.

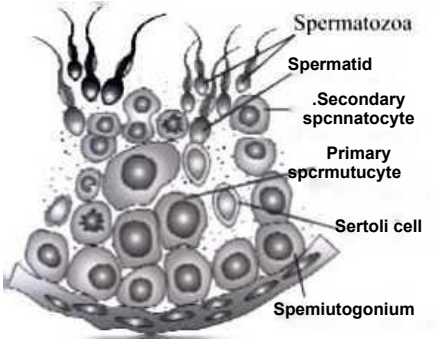


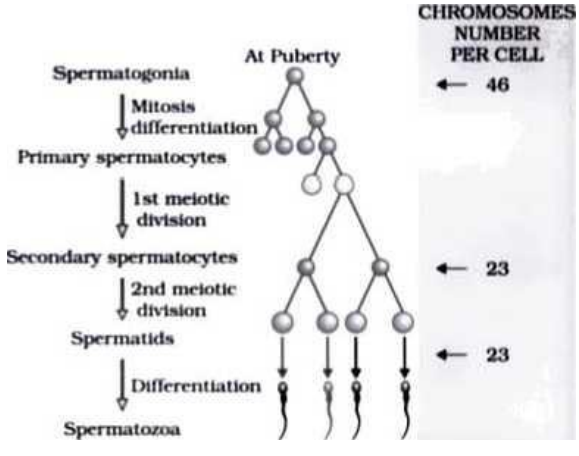
Fig.: Diagrammatic sectional view of a seminiferous tubule (enlarged)

© A primary spermatocyte completes the first mciotic division (reduction division) leading to fbrmation of two equal, haploid cells called secondary spermatocytes, which have only 23 chromosomes each.

© The secondary spermatocytes undergo the second mciotic division to produce four equal, haploid spermatids.

◎ Spermiogenesis is the process of formation of flagellated spermatozoa from spermatids.

© Spcrmiogcncsis begins in the seminiferous tubules but usually completed in epididymis.



Fie.: Schematic representation of s perma toecncs is

© After spcmiiogcncsis. sperm heads become embedded in the sertoli cells, and arc finally released from (he scminilcrous tubules by the process called spermiation.

Structure of Sperm

© Spemi is a microscopic structure composed of tour parts, i.e., head, neck, middle piece and tail.

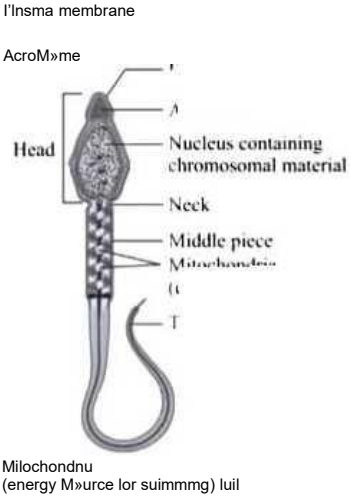
(i) Head

© Head contains two structures:

(a) Acrosomc (b) Nucleus

© Acrosomc is a vesicle-like double membranous structure which has hydrolytic enzymes. It is formed of collection of golgi bodies. These arc combincly known as spermlysin. These enzymes help in penetration of egg.

Q Mammalian acrosomc has mainly hyaluronidase and proacrosinc/zoniilysln enzyme. Both arc collectively known as acrosominc.



HR.: Structure of a sperm

◎ If acrosomc is removed from a spemi. it will fail to penetrate the ovum.

(ii) Neck: It is very short containing two centrioles, namely, proximal and distal centriole.

(iii) Middle piece

O In middle piece, numerous mitochondria arc arranged spirally around to axoncmc.

◎ This spiral sheath of mitochondria around (he axonema is known as Nebenkern sheath.

-*KEYNOTE* - Mitochondria produce energy for the movement of tail that facilitate sperm motility essential for fertilisation.

(iv) Tail - It is a long flagellum, its basal body is distal centriole. © Tail is divided into two purts:

(a) Main piece

(b) End piece

Q Main piece of axoncmc is surrounded by two solid protein fibres. A thin layer of cytoplasm present in main piece of the tail.

◎ End piece of tail consist of only axoncme and 9 + 2 arrangement.

Oogenesis

◎ The process of to miat ion of a mature temalc gamete is called oogenesis.

Oogenesis is discontinuous process.

◎ Oogenesis begin before birth unlike that of spcmiatogcncsis, stop in midp roecss and only resumes a year after mcnarch (the first menstrual bleeding).

◎ Oogenesis is initiated during the embryonic development stage when a couple of million gamete mother cells (oogonia) arc tomicd within each tctal ovary; no more oogonia arc formed and added after birth. These cells start division and enter into prophase-1 of the meiotic division and gel temporarily arrested at that stage, called primary oocytes.

◎ Each primary oocyte then gets surrounded by a layer of granulosa cells and then called the primary follicle. A large number of these follicles degenerate during the phase from binh to pubeny. Therefore, at puberty only 6().(M)0-80,0(X) primary follicles arc left in each ovary.

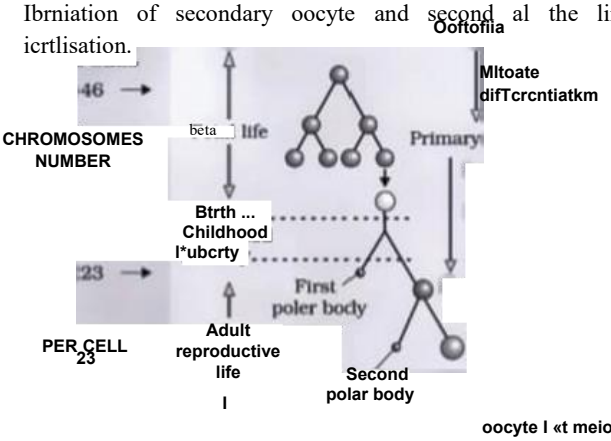
◎ The primary follicles get surrouixlcd by more layers of granulosa cell and a new theca and arc called secondary follicles. The secondary tblliclc soon transforms into a tertiary follicle which is cliaractcriscd by a fluid tilled cavity called antrum.

◎ The theca layer is organised into an inner theca interna and an outer tlicca externa. Al this stage that the primary' ooctc within the tertiary follicle grows in size and completes its first meiotic division. It is an unequal division resulting in the lomiation of a large haploid secondary oocylc and a liny first polar body.

© The tertiary follicle further changes into the mature follicle or Graafian follicle. The secondary oocyte form a new membrane called zona pellucida surrounding it. The Graafian follicle now ruptures to release the secondary oocyte (ovum) from the ovary by the process called ovulation.

◎ Oogenesis ends at menopause (Cessation of menstrual cycle near the age of 50 naturally).

◎ Two polar bodies arc formed only in oogenesis first at the time of Ibrniation of secondary oocyte and second al the lime icrtlisation.



FIR.: Schematic representation of oogenesis

Structure of Ovum

- An ovum is generally spherical, non-motile gamete with or very few yolky cytoplasm and is enclosed in one or more egg.
- Size of ovum varies in different animals and depends upon the amount of yolk. Size of ovum varies from 1 Op to a few cm. Egg size and yolk amount arc interdependent. In mammals, it is generally microlecithal and about lOOp.
- The life span of eggs in female reproductive organs in human being is 24 hrs.

| MENSTRUAL CYCLE

- Menstrual cycle is the cyclic changes in the reproductive tract of primate females (c.g.. monkeys, apes and human beings)
- Menstruation is the periodic shedding of the endometrium of the uterus with bleeding.
- In healthy women, menstruation occurs at an average interval of about 28/29 days.
- Menarche is the beginning of menstruation in girls at about 13 years (at puberty).
- Menstrual cycle consists of three phases, i.e., menstrual phase, proliferative phase (follicular phase) and secretory phase (luteal phase).

(i) Menstrual Phase:

- The cycle starts with menstrual phase in its first 3 to 5 days.
- During this, the part of the layer of endometrium gets shed off. © 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.

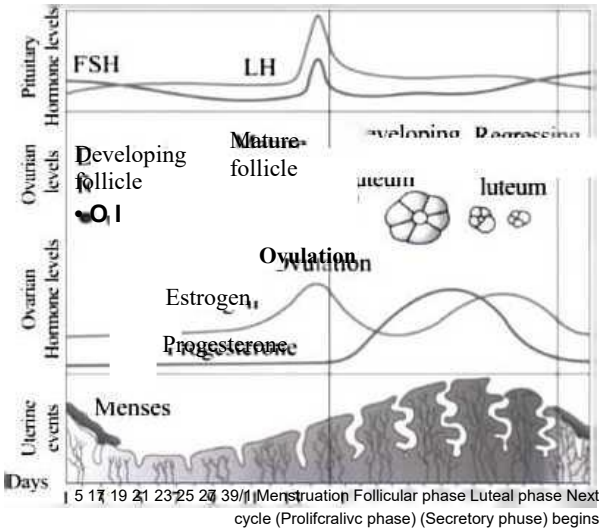
-*KEYNOTE* - Menstruation only occurs if the released ovum is not fertilised. Lack of menstruation may be indicative of pregnancy. However, it may also be caused due to some other underlying causes like stress, poor health etc.

(ii) Preovulatory/Proliferative phase:

© During this phase, due to release of some GnRH. pituitary secretes some FSH to stimulate the ovarian follicle.

© The ovarian follicle now begins to develop. Developing follicle now starts secreting an increasing amount of estrogen.

- The rising level of estrogen causes the endometrium to proliferate and thicken. It also causes increase in the vascularity and glandularity of the endometrium.
- Due to this, the hypothalamus releases more of GnRH. This GnRH induces the pituitary to release more ofFSH. The rising FSH levels results in :
  - (a) funher growth and development of ovarian follicle to form Graafian follicle
  - (b) even further release of estrogen from the theca interna of the devel opine follicle.
- As the estrogen level goes on rising, by the end of 10[h] day the extreme levels of estrogen (which have by then caused maturation of Graafian follicle and growth of endometrium) gives a positive feedback to hypothalamus and pituitary causing a rise in GnRH and LH secretion.
- FSH is not comparatively rised therefore the LH secretion from the pituitary goes on rising. This abrupt rise (on 11th to 13th day) in LH concentration in blood is called as LH surge.
- Increased concentration of LH causes the Graafian follicle to rupture thereby the release of ovum. Tlic release of egg (secondary oocyte) which occurs around 14th day is called as ovulation.



Developing Regressing j:orpus corpus Juteum

Fig.: Diagrammatic presentation of various events during a menstrual cycle

(iii) Post ovulatory/secretory phase:

- After ovulation, the ruptured Graafian follicle transforms into corpus lutcum. The granulosa and theca cells of the ruptured Graafian follicle (which is now called as corpus lutcum) is found only in mammals and contain a yellow lutein or carotene pigment.

-*KEYNOTE* - The corpus lutcum secretes large amounts of progesterone which is essential for maintenance of the endometrium. Such an endometrium is necessary for implantation of the fertilised ovum and other events of pregnancy.

- During pregnancy all events of the menstrual cycle stop and there is no menstruation. In the absence of fertilisation, the corpus lutcum degenerates. This causes disintegration of the endometrium leading to menstruation, marking a new cycle.

-*KEYNOTE* - In human beings, menstrua)

cycles ceases around 50 years of age; that is termed as menopause. Cyclic menstruation is an indicator of normal reproductive phase and extends between menarche and menopause.

Menstrual Hygiene

Q Maintenance of hygiene and sanitation during menstruation is very imporlunt.

- ◎ Take bath and clean yourself regularly. Use sanitary napkins or clean homemade pads.
- ◎ Change sanitary napkins or homemade pads after every 4-5 hrs as per the requirement.
- ◎ Dispose of the used sanitary napkins properly wrapping it with a used paper.
- ◎ Do not throw the used nupkins in the drainpipe of toilets or in the open area.

O After hundling the napkin wash hands with soap. | FfcKlILISAIION

ANU iMPLANIAnON

© The process of fusion of a sperm with an ovum to form a diploid cell is called fertilisation.

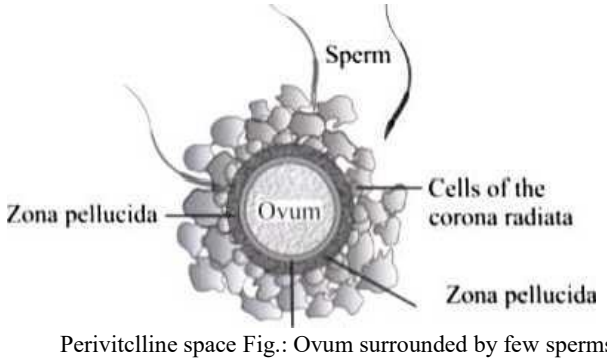
® Fertilisation activates the secondary oocyte cell to complete the division.

◎ It normally occurs when sperm and egg interact in the upper part of the oviduct (ampulla).

© During fertilisation, a sperm comes in contact with ovum (zona pcllucida layer) and induces changes in the membrane that block the entry of additional sperms. Thus, it ensures that only one sperm can fertilise an ovum.

® Polyspermy is the entry of more than one sperm nucleus into an ovum at fertilisation.

◎ When the acrosomc of the spermatozoa touches the surface of egg. the cytoplasm of the egg bulges forward forming receptive cone or fertilisation cone (a region where sperms enters lhe egg).



Perivitclline space Fig.: Ovum surrounded by few sperms

◎ The secretions of the acrosomc help the sperm enter into the cytoplasm of the ovum through the zona pcllucida and the plasma membrane. This induces the completion of the mciotic division of the secondary oocyte.

© Tlic second mciotic division is also unequal and results in the formation of a second polar body and haploid ovum (ootid). Soon the haploid nucleus of the sperms and that of the ovum fuse together to form a diploid zygote.

—*KEYNOTE* - Fertilisation can only occur if the ovum and sperms arc transported simultaneously to the ampulla. This is the reason why not all copulations lead to fertilisation and pregnancy. © Cleavage is the mitotic division of the zygote unit moving through the isthmus of the oviduct towards the uterus and forms 2.4. 8. 16 daughter cells called blastomeres. © Cleavage occurs more readily in the active cytoplasm.

◎ Cleavage in humim is equal holoblastic.

© Morula is a solid ball of 8-16 cells without a cavity. Morula looks like a little mulberry.

◎ Morula changes to blastula due to rearrangements of blaKtomorcs.

O Blastula formation is called blaitulation. O Mammalian hlastula with a large blastococl is called blastoyst (in humans).

◎ Blastocyst has 3 parts-trophoblast. inner cell mass and blastocoel.

◎ The blastomeres in the blastocyst arc arranged into an outer layer called trophoblast and an inner group of cells attached to trophoblast called the inner cell mass.

◎ The trophoblast layer then gets attached to the endometrium and the inner cell mass gets differentiated as the embryo.

◎ After attachment, the uterine cells divide rapidly and covers the blastocyst. As a result, the blastocyst becomes embedded in the endometrium of the uterus. This is called implantation (or nidation) and it leads to pregnancy.

◎ Implantation occurs generally between 6^{th} to 9^{*fc} day alter fertilisation.

◎ The site of implantation determines the portion of placenta.

◎ In human, implantation is of interstitial type in which embryo is buried in the uterine epithelium which completely surrounds it.

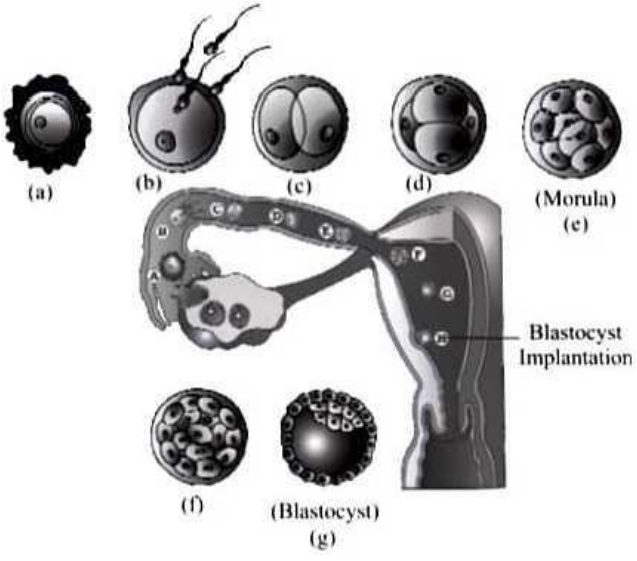


Fig.: Transport of ovum, fertilisation and passage of growing embryo through fallopian tube

◎ After implaniation. fingcr-likc projections appear on the trophoblast called chorionic villi which are surrounded by the uterine tissue and maternal blood.

| Pregnancy and Embryonic Development

◎ The ehorionic villi and uterine tissue become interdigitated with each other and jointly form a structural and functional unit between developing embryo (foetus) and maternal body called placenta.

◎ The placenta facilitate the supply of oxygen and nutrients to the embryo and also removal of carbon dioxide and excretory/waste materials produced by the embryo.

◎ The placenta is connected to the embryo through an umbilical cord which helps in the transport of substances to and from the embryo.

◎ Placenta also acts as an endocrine tissue and produces several hormones like human chorionic gonadotropin (hCGK human placental lactogen (hPL), estrogens, progestogens, etc.

◎ In the later phase of pregnancy, a hormone called relaxin is also secreted by the ovary.

-*KEYNOTE* - hCG, hPL and relaxin are produced in women only during pregnancy.

◎ In addition, during pregnancy the levels of other hormones like estrogens, progestogens, cortisol^ prolactin, thyroxine, etc., arc mcrcascd (essential for supporting the foetal growth, metabolic changes in (he mother and mamtcnance of pregnancy).

◎ Immediately after implantation, tlie inner cell mass (embryo) difTerentiatcs into an outer layer called ectoderm and an inner layer called endoderm.

◎ A mesoderm soon appears between the ectoderm and the endoderm.

◎ These three layers give rise to all tissues (organs) in adults.

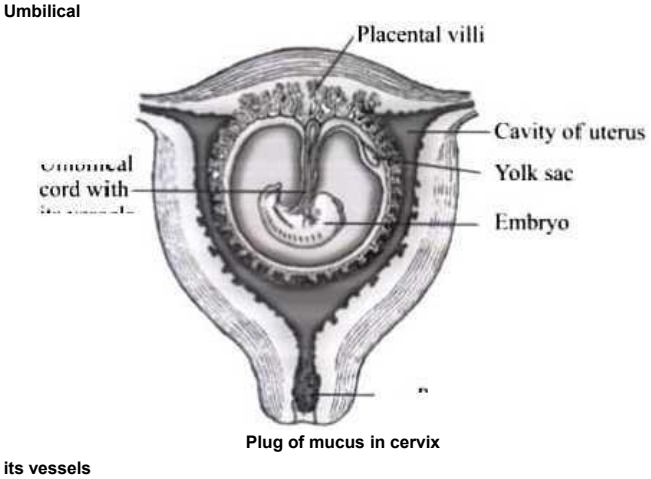


Fig.: The human foetus within the uterus

-*KEYNOTE* -

The inner cell mass contains certain cells called stem cells which have the potency to give rise to all the tissues and organs.

© The human pregnancy lasts 9 months.

◎ In human beings, after one month of pregnancy, the embryo's hcari is formed.

© The first sign of growing foetus may be noticed by listening to the heart sound carefully through the stethoscope.

© By the end of the second month of pregnancy, the foetus develops limbs and digits.

◎ By the end of 12 weeks (first trimester), most of the major organ systems arc formed, for example, the limbs and external genital organs arc well-developed.

◎ The first movements of the foetus and appearance of hair on the head arc 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.

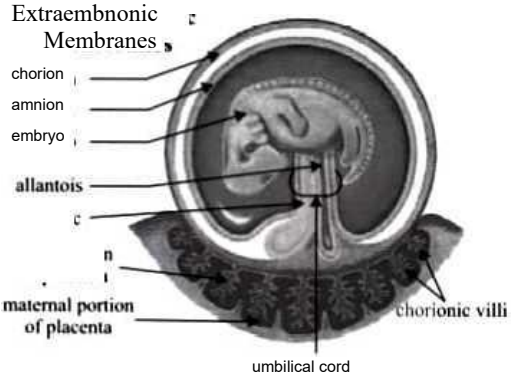
© By the end of nine months of pregnancy, the foetus is fully developed and is ready for delivery. **| EXTRA EMBRYONIC MEMBRANES**

yolk sac Ictal portion of pheenta

Chorion

Forms the foetal part of placenta and helps in implantation

Formed of outer trophoblast(ectoderm) and inner extra embryonic



mesoderm

Amnion

Forms amniotic sac which contains amniotic fluid Functions of amniotic fluid:

◎ Shock absoipdon

© Cushion

© Antibacterial

◎ Prevent dessication

◎ Regulate temperature

Formed of outer extra embryonic mesoderm and inner amniogcnic layer (ectoderm)

Yolk sac

Site of early erythropoiesis in fetus Forms germinal epithelium

formed of outer extra embryonic mesoderm and inner endoderm

Allantois

Vorms primitive urinary bladder

Formed of outer extra embryonic mesoderm and inner endoderm.

•Yolk sac and allantois in mammals is highly reduced.

PARTURITION

© 1'hc average duration of human pregnancy is about 9 months which is called the gestation period.

© Vigorous contraction of the uterus al the end of pregnancy causes cxpulsion/dclivcry of lhe foetus.

◎ This process of delivery of lhe foetus (childbirth) is called parturition.

© Parturition is induced by a complex neuroendocrine mechanism.

-KEY NOTE - The signals for parturition originate from the fully developed foetus and (he placenta which induce mild uterine contractions called foetal ejection reflex.

◎ The foetal ejection reflex triggers release of oxytocin from the maternal piluitan*.

O Oxytocin acts on the uterine 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 leads to expulsion of the baby out of the uterus through the birth canal - parturition. Soon after the infant is delivered, the placenta is also expelled out of the uterus.

Lactation

O The mamman* glands of the female undergo differentiation during pregnancy and starts producing milk towards the end ol pregnancy by the process called lactation.

◎ Prolactin helps in secretion of milk and oxytocin helps in milk let down.

◎ This helps the mother in feeding the new- bom.

-KEYNOTE ~ Tlic milk produced during the initial few days of lactation is called colostrum which contains several IgA absolutely essential to develop resistance for the new-bom babies.

© Breast-feeding during the initial period of infant growth is recommended by doctors lor bringing up u healthy baby.