REPRODUCTIVE SYSTEM

1 REPRODUCTION AND ITS TYPE.

Reproduction : Reproduction is the ability of living organism to produce a new generation of living individuals similar to themselves.

Basic features of reproduction : All organisms reproduce. Modes of reproduction vary in different organisms. However, all modes have certain common basic features. These are

(i) Replication of DNA. This is the molecular basis of reproduction.

(ii) Cell division, only mitotic, or both mitotic and meiotic. This is cytological basis of reproduction.

(iii) Formation of reproductive bodies or units.

(iv) Development of reproductive bodies into offspring.

Types of reproduction : These are of two main types

(i) Asexual (Non-gametic) (ii) Sexual (gametic)

(i) Asexual reproduction

(a) **Definition :** Production of offspring by a single parent without the formation and fusion of gametes is called asexual reproduction. The young one receives all its genes from one parent.

□ A sexual reproduction is also known as agamogenesis or agamogeny.

□ It involves only mitotic cell divisions, and also termed somatogenic reproduction.

□ Asexual reproduction produces identical offspring commonly referred to as a clone. Today, the scientists have been able to produce clones of multicellular animals (e.g., boar calf names as Frosty, and Finn Dorset lamb named as the famous Dolly) artificially in the laboratory.

(b) **Occurrence :** Asexual reproduction occurs in protozoans and some lower animals such as sponges, coelentrates, certain worms and tunicates. It is absent among the higher non-vertibrates and all vertibrates.

(c) **Types :** Asexual reproduction takes place in five principal ways :

(1) **Binary fission :** Binary fission is the division of the parent into two small, nearly equalized daughter individuals. Examples – Protozoans (Amoeba, Euglena etc.) Bacteria and Planarians.

Modes of binary fission : In Binary fission, the nucleus divides first and the cytoplasm next. Subsequently, the mother cell splits into two equal sized daughter halves or cells. There are three modes of binary fission.

(i) **Simple binary fission :** If the plane of cytoplasmic division passes through any direction, the fission is called simple fission. Example – Amoeba.



Fig. – Simple binary fission in amoeba

(ii) **Transverse binary fission :** If the plane of cytoplasmic division concides with the transverse axis of the individual, the fission is termed transverse binary division. Example – Paramoecium and Planaria.



Fig. – Transverse binary fission in paramecium

(iii) **Longitudinal binary fission :** It the plane of cytoplasmic division concides with the longitudinal axis of the individual. This kind of fission is designated as longitudinal binary fission. Example – Euglena and vorticella.



Binary fission involves mitotis only and consequently, the resultant offspring's are genetically identical to the parent and each other.

(2) Multiple fission : Multiple fission is the division of the parent into many small daughter



man

individuals simultaneously. Examples – Multiple fission occurs in many protozoans such as Plasmodium, Amoeba and Monocytis.

Mode of multiple fission : Sometimes, the nucleus divides several times by amitosis to produce many nuclei, without involving any cytokinesis. Later, each nucleus gathers a small amount of cytoplasm around it and the mother individual splits into many tiny daughter cells.

In course of time, each of these daughter cells starts a free life and transforms into an adult individuals. This kind of fission is called multiple fission.

(i) **Encystation :** In response to unfavourable living condition, an Amoeba withdraws its pseudopodia and secretes a three-layered hard covering or cyst around itself. This phenomenon is termed as encystation.

(ii) **Sporulation :** During favourable condition, the encysted Amoeba divides by multiple fission and produces many minute amoebae or pseudopodiospores; the cyst wall burst out, and the spores are liberated in the surrounding medium to grow up into many amoebae. This phenomenon is known as sporulation.

(iii) **Schizogony :** It is a type of multiple fission present in plasmodium. Schizogonies are of two type. Liver schizogony and blood schizogony.

(3) **Plasmotomy :** Plasmotomy is the division of a multinucleate protozoan into several small, multinucleate daughters without nuclear division. The daughters grow and regain the normal number of nuclei by nuclear divisions. The daughters grow and regain the normal number of nuclei by nuclear division. It takes place in Opalina and Pelomyxa.

(4) **Budding :** Formation of a daughter individual from a small projection, the bud, arising on the parent body is called budding. It is a common method of asexual reproduction. In budding new individual form by mitosis. Examples – Budding occurs in some protozoans and certain lower animals such as sponges (Scypha), coelenterates (Hydra), annelids (chaetopterus) and tunicates (Salpa).

Types of budding : There are two types of budding

(i) **Exogenous or External budding :** Initially, a small outgrowth of the parent's body develops into a miniature individual. It then separates from the mother to lead a free life. This type of budding is recognised as exogenous budding. Example – Hydra.

(ii) Endogenous or Internal budding : In fresh water sponges (e.g. – Spongilla) and marine sponge (e.g. – Sycon), the parent individual releases a specialised mass of cells enclosed in a common opaque envelope, called the gemmule, on germination. Each gemmule gives rise to an offspring gemmules are thought to be internal buds. This type of budding recognised as endogenous budding. Example – Sycon and Spongilla.

(5) **Fragmentation :** It is the breaking up of an animal's body into two or more pieces, each of which grows into a new individual. Examples – It occurs in the flatworm, microstomum.

(d) **Special asexual reproductive bodies :** Archeoocytes of sponges are totipotent cells. They take part in the formation of gemmules. Gemmules form new sponges.



(e) **Reproductive units in asexual reproduction :** Reproductive units vary in different forms of asexual reproduction. These are entire parent bodies in binary and multiple fission's and are small parts of parent body in budding and fragmentation. An asexual reproductive unit is called blastos.



Fig. – External hudding in

(f) **Characteristics of asexual reproduction :** All forms of asexual reproduction have certain common basic features. These are under –

(1) A single parent produces offspring, that is, asexual reproduction is uniparental.

(2) Gametes are not formed.

(3) Cell divisions are only mitotic.

(4) The new individuals formed are usually genetically identical to the parent. Variability, if it occurs, is restricted to mutation only.

(5) Multiplication occurs rapidly.

(6) The offspring are often formed in large numbers near the parent.

(g) Significance of asexual reproduction : Asexual reproduction brings multiplication of the

species only. It does not play a role in evolution as no variation is introduced into the new individuals formed by it. Asexual reproduction is theoretically most advantageous in stable, favourable environment because it perpetuates successful genotypes precisely.

(ii) Sexual reproduction

(a) **Definition :** It is the production of offspring usually by two parents, male and female. Involving four processes :

(1) Formation of special haploid cells, the gametes, by meosis. (Gametogenesis)



(2) Fusion of the gametes in pairs, forming diploid cells, the zygotes (Fertilization)

(3) Repeated mitotic divisions of zygotes to form embryos (Embryogenesis)

(4) Growth of Embryos into a new individuals (Development)

□ Sexual reproduction is also called syngenesis.

(b) **Occurrence :** Sexual reproduction occurs nearly in all mammals, including those which reproduce asexually. Some protozoans, such as Amoeba, Euglena lack sexual reproduction. In most and female, and the difference between them is determined genetically. In sexual reproduction offsprings resemble the parent.

(c) Types : Sexual reproduction is of two main types –

(1) Amphigony (2) Parthinogenesis

(1) **Amphigony :** It involves the complete and permanent fusion of two gametes from differents or from the same parent to form a composite cells, the zygote. It is further of two kinds :

(i) Syngamy (ii) Conjugation

(i) **Syngamy :** It involves the fusion of two entire gametes to form a zygote. It is further of two types with regard to the source of fusing gametes :

(a) **Endogamy :** It involves self-fertilization, *i.e.*, the fusion of two gametes of the same parent. It is, thus uniparental. It is not common. It is found in Taenia, a tapeworm. Tapeworm is a bisexual (hermaphrodite, monoecious) animal.

(b) **Exogamy :** It involves cross-fertilization, *i.e.*, the fusion of two gametes formed by different parents. It is, thus, biparental. It is very common. It is found in frog, rabbit and man. Syngamy is also of two kinds with regard to the structure of the fusing gametes :

(a) **Isogamy :** The fusing gametes are similar morphologically as in Monocytis, a protozoans. Such gametes are known as isogametes, and their fusion is termed isogamy. Although the isogametes are similar in structure, they have behavioural differences. The gametes produced by one parent do not fuse with each other.

(b) **Anisogamy or Heterogamy :** The fusing gametes are different in form, size structure and behaviour as in frog and humans. Such gametes are known as anisogametes, or heterogametes, and their fusion is termed anisogamy, or heterogamy.

Special forms of syngamy : These are two special forms of syngamy :

(a) **Neoteny :** Development of gonads and sexual reproduction in the larval stage of an animal is called neoteny. It is found in the axolotl larva of the salamander Ambystoma.

(b) **Polyembryony :** The blastomeres formed by division of the zygote separate in early stages of development, each producing in a complete individual (fasciola liver fluke). Armadillo regularly produces four young ones per zygote. Identical twins in human beings is another example.

(ii) **Conjugation :** Some acellular protist animals (*e.g.* Paramaecium) exhibit sexual reproduction by forming male and female gamete nuclei, which they exchange through temporary cytoplasmic bridge; later, the cytoplasmic bridge disappears and the gamete nucleus of one individual fuses with that of the other to form zygote nuclei. This mode of sexual reproduction is known as conjugation.

(2) **Parthenogenesis (Virgin birth) :** It is a modification of sexual reproduction in which an egg develops into a complete offspring without fertilization. It is monoparental. Parthinogenesis was discovered by Bonnet (1745).

Occurrence : Parthinogenesis is found in many non vertebrates such as rotifers, aphids, bees and crustaceans. It also occur in a few vertebrates.

Types : Parthenogenesis is of two main types -

(i) **Natural parthenogenesis :** It is a regular phenomenon in the life history at some animals. It may be three type.

(a) **Complete** (**Obligatory**) **parthenogenesis** : Males are absent, females develop parthenogenetically, *e.g.*, rotifers, Typhlina brahmina (small lizard, 15 cm long), Lacera saxicola-armeniaca (Caucasian Rock Lizard), Cnemidophorus (Whiptail Lizards of America).

(b) **Incomplete (cyclic) parthenogenesis :** Some animals have both sexual and parthenogenetic individuals, which may alternate. In these animals, female can produce unfertilized or fertilized eggs, depending upon environmental conditions. In Daphina, a fresh water crustacean, female lays unfertilized eggs that develop parthenogenetically under favourable conditions, and fertilized eggs during times of environmental stress. In aphids, the insects pests or crops, females produce many parthenogenetic generations from unfertilized eggs alternating with a biparental generation from fertilized eggs.

In honeybee, unfertilized eggs develop into male bees (drones) with haploid cells, and fertilized eggs give rise to females (queen bees and worker bees) with diploid cells. Spermatogenesis in drones is peculiar in lacking reduction division. In turkey, about 40% males are produced by parthenogenesis whereas 60% males and all females develop from fertilized eggs.

(c) **Paedogenetic parthenogenesis :** In certain insects, larvae lay eggs which develop parthenogenetically into a new generation of larvae. Parthenogenesis is larvae is called paedogenesis.

(ii) Artificial parthenogenesis : Eggs of certain animals, such as annelids, mollusks, starfish, frog, hen, rabbit, etc., can be induced to develop parthenogenetically by artificial stimuli. Artificial stimuli may be (i) physical, viz., prick of a needle, electric shock, change in temperature or pH; or (ii) chemical such as addition of urea, fatty acids, ether, chloroform, to water.

On the basis of chromosome sets parthinogenesis is of two types -

(a) **Arrhenotoky (Haploid parthenogenesis) :** Haploid eggs grow to form haploid males *e.g.*, Arachnids, some insects (honey bees).

(b) **Thelotoky** (**Diploid parthenogenesis**) : Diploid eggs grow without fertilization in to diploid individuals, generally females. *e.g.*- Gall fly.

Advantages of parthenogenesis

□ This avoids the wastage of germplasm as sperms and ova. Adult organism is devoted exclusively to feeding and reproduction so is a mode of high reproduction e.g., aphids.

□ There is no chance of separation of useful combination of genes by crossing over and are transmitted as such.

□ The offsprings are exactly similar to parents.

□ Haploid parthenogenesis is the direct proof of chromosomal theory of sex-determination.

Disadvantages of parthenogenesis : It stops the chances of new combinations of genes and thus avoids selection in population. It decreases the chances of adaptability followed by extinction.

(d) **Reproductive unit in sexual reproduction :** The reproductive units in sexual reproduction are specialised cells called gametes. The gametes are generally of two kinds –

(1) Microgametes or Spermatozoa (2) Macrogametes or Ova

Both are well developed for their role in reproduction. The male gametes are mostly minute and motile so that they may swim to the female gametes for fertilization. The female gametes are usually large, non motile and often have a store of food to nourish the developing embryo.

(e) **Maintenance of chromosome number :** The gametes are usually formed by meiotic divisions. Therefore, they are haploid, *i.e.*, have halved or reduced (n) number of chromosomes. In sexual reproduction, the male and female gametes fuse to form a single cell, the zygote formed by the fusion of two haploid gametes in naturally diploid, *i.e.*, has double or normal number (2n) of chromosomes. The zygote gives rise to the offspring by mitotic divisions. Thus, the offspring is also diploid like its parents which formed haploid gametes by meiosis for its creation. Meiosis and fertilization are the two important events in sexual reproduction that keep the number of chromosomes constant from generation to generation.

(f) **Reproduction pattern :** Sexual reproduction shows three patterns depending on whether fertilization and embyronic development occur within or outside the maternal body –

(1) External fertilization and External development : This pattern is found in many aquatic animals, such as Obelia, Nereis, Labeo and frog. Parents release sperms and eggs into the surrounding water, where fertilization occurs and zygotes develop into offspring. For this pattern to succeed, male and female must shed their gametes at the same time and place and in large numbers. the parents may or may not make a physical contact for releasing the gametes.

(2) **Internal fertilization and External development :** Sperms are passed from the male into the female with an intromittent organ, such as a penis as in shark and lizard, or otherwise, for example, by cloacal apposition in birds, with modified arm in cuttle fish. Internal fertilization has several advantages. The female reproductive tract provides a confines, protected place where sperm and egg can easily meet without the danger of being eaten up by predators or washed away by water currents.

The zygote passing down the female reproductive tract to the exterior can acquires secretions, membranes, or shell for the protection of the developing embryo.

Animals with internal fertilization usually produce fewer zygotes because of protection provided by egg shells or internal development.

(3) **Internal fertilization and Internal development :** Internal development provides additional advantages to the embryo. The mother's body provides exactly the right chemical conditions and, in mammals, warmth and nourishment also. As the mother carries the embryo wherever she goes, it is not vulnerable to predators who attack externally developing eggs.

(g) **Characteristics of sexual reproduction :** Sexual reproduction has the following important basic features –

(1) It is generally biparental.

(2) It involves formation of male and female gametes.

(3) Mostly there is fusion of male and female gametes (fertilization).

(4) Cell divisions are meiotic during gamete formation and mitotic during development of zygote into an offspring.

(5) The offspring are not genetically identical to the parents. They show variation as they receive characters (chromosomes) from two different parents. Sexual reproduction is, thus, a source of variety in population.

(h) **Significance of sexual reproduction :** Sexual reproduction has a dual significance for the species –

(1) It results in multiplication and perpetuation of the species.

(2) It contributes to evolution of the species by introducing variation in a population much more rapidly than asexual reproduction.

S.No.	Asexual	Sexual reproduction	
	reproduction		
1.	It is always	It is generally	
	uniparental.	biparental.	
2.	It invariably	It may not result in	
	results in	increase in the number	
	increase in the	of individuals.	
	number of		
	individuals.		
3.	Gametes are	It always involves the	
	not formed.	formation and fusion of	

Difference between sexual and asexual reproduction

		gametes.
4.	There is no	Fertilization generally
	fertilization.	occurs.
5.	It involves	It involves meiotic
	only mitotic	divisions during gamete
	cell divisions.	formation and mitotic
		divisions during
		development of zygote
		into an offspring.
6.	Daughter	Daughter individuals
	individuals are	genetically differ from
	genetically	the parents.
	identical to the	
	parent.	
7.	It occurs in	It occurs nearly in all
	only lower	animals.
	invertebrates	
	and lower	
	chordates.	
8.	It contributes	It contributes to
	little to	evolution by
	evolution.	introducing variation in
		offspring.
9.	It often causes	It causes slower
	rapid increase	increase in number.
	in number.	

□ Blastogenesis and Embryogenesis : Development of the offspring from reproductive units, such as buds or fragments, in asexual reproduction is called blastogenesis. Development of the embryo from the zygote in sexual reproduction is termed embryogenesis.

□ Unisexual or dioecious : Organism in which the two sexes occur in different individuals, *e.g.*, humans, mammals, birds, lizards.

□ **Bisexual / Hermaphrodite or monoecious :** Organism in which the two types of sex organs (testes and ovaries) occur in the same individual, *e.g.*, Earthworm, Taenia.

Deviations in the reproductive strategies : Although asexual and sexual reproductions are the two major trends of breeding, many deviations are also observed in the reproductive strategies of

animals. One such variation in reproductive strategy in hermaphroditism, found in tapeworms and earthworms. Tapeworms are self-fertilising; the sperm produced in the testes of one individual can fertilise the eggs produced by the same individual. The earthworms employ cross, fertilisation; the sperm of one individual fertilises the eggs of the other.

Sexual dimorphism : Differentiation in morphology of the two sexes of the same species is called sexual dimorphism. Example – Ascaris, Oryctolagus and humans etc.

Human reproductive system

In human beings, reproduction takes place by sexual method and the sexes are separate. The primary sexual organs of males and females are the testes (sing. testis) and the ovaries (sing. ovary)., respectively. The males are also different from the females in the secondary sexual features or accessory sex organs. Also, the humans exhibit sexual dimorphism. For example, the mammary glands are well developed in the females are rudimentary in males; the females do not develop beard and moustache but males do; the voice in females is pitched higher than in males.

(i) **Sex organs :** Human are unisexual. The reproductive system of each sex consists of many organs. The latter are distinguishable into primary and secondary sex organs. Besides these, there are some accessory sex characters –

(ii) **Primary sex organs :** Gonads which form gametes are called primary sex organs – testis (plural testes) in males and ovary (plural ovaries) in females. Testis produces sperms and secrets testosterone (formation and maintenance of secondary sex organs, accessory male glands and external sex characters). Ovary produces ova. Maturing Graffian follicles secrete estrogens for development and maintenance of secondary sex organs, accessory or external sex characters and part of menstrual cycle. Projesterone produced by ruptured Graffian follicles or corpus luteum controls a part of menstrual cycle, implantation and development of placenta.

(iii) **Secondary sex organs :** Sex organs, glands and ducts which do not produce gametes but are otherwise essential for sexual reproduction are known as secondary sex organs. In human male reproductive system, the secondary sex organs are vasa efferentia, epididymes, vasa deferentia, ejaculatory ducts, seminal vesicles, urethra, prostate glands, Cowper's glands and penis. Secondary sex organs of a human female include fallopian tubes, uterus, vagina, external genitalia, Bartholin's gland and mammary glands.

(iv) Accessory / External / Secondary sex characters : They are traits which do not have any direct role in reproduction but provide specific features and structures to the two sexes. The important external / accessory sex characters of human male are beard, moustaches, body hair on shoulder and chest, pubic hair on both lateral and vertical directions, comparatively more height with more muscular body, larynx apparent externally, voice low pitched with breathing more by means of diaphragm. The important accessory sex character of human females are high pitched voice, breast, broader pelvis, lateral pubic hair, rounded body contours with more subcutaneous fat in thighs buttocks and face and sternal breathing.

(v) **Puberty :** Beginning of sexual maturity or ability to reproduce is known as puberty. Primary sex organs begin functioning. Secondary sex organs develop fully under the influence of sex hormones produced by primary sex organs. Growth is rapid. It is accompanied by slow development of accessory/external sexual characters. Puberty occurs at the age of 10 - 14 years in girls and 13 - 15 years in boys.

(vi) Characteristics of human reproduction :

(a) Human beings are non-seasonal breeders.

(b) There is no oestrus / heat.

(c) In human females the ability to produce young ones begins at menarche (beginning of menses) and ends at menopause (stoppage of menses).

(d) In human females the reproductive phase has 28 day repeated menstrual cycle.

(e) Fertilization is internal.

(f) There is vivipary, i.e., giving birth to young ones.

(g) Foetus develops inside uterus and is nourished by joint special structure called placenta.

(h) Infants can be fed on mother's milk.

(i) Parental care is very well developed.

8.2 MALE REPRODUCTIVE SYSTEM

The male reproductive system consists of a scrotum, a pair of testes, vasa efferentia, a pair of epididymis, a pair of vasa deferentia, a pair of ejaculatory ducts, a urethra, a penis and certain glands.

(i) **Reproductive organ**

(a) Scrotum : The scrotum is a pouch of pigmented skin arising from the lower abdominal wall and hanging between the legs. Its dermis contains almost a continuous layer of smooth muscle fibres called dartos tunic. The scrotum is divided internally into right and left scrotal sacs by a muscular partition, the septum scroti. A scar like raphae marks the position of the septum externally. The testes originate in the abdominal but latter, during the seventh month of development, descend permanently into the respective scrotal sac through passages termed inguinal canal. If an inguinal canal remains open or is torn, a loop of intestine may descent in the



scrotum to produce the disorder of inguinal hernia.

□ A spermatic cord connects testis with abdominal cavity. It consists of connective tissue that encloses an artery, a vein, a lymph vessel, a nerve, cremaster muscle and a vas deferens. A testis rests in it chamber over pad called gubernaculum.

□ Descent of testes in scrotum provides a low temperature (of $2C^{\circ}$) for maintenance of spermatogenic tissue and formation of sperms. Failure of testes to descend in scrotum is cryptorchidism, the disorder that causes sterlity because sperm formation does not occur at the abdominal temperature.

□ Men persistently wearing tight underpants or taking very hot baths may have a reduced sperm count almost leading to infertility.

☐ The scrotal sac of male homologous to female's labia majora.

Variations in position of testes : In some mammals (lion, bull, horse), the testes remain permanently in the scrotum and keep functioning throughout the year as in man. In certain seasonally breeding mammals, such as bat, otter and llama,



(Insectivora, Tubulidentata, chiroptera and most Rodentia) the testes enlarge, become functional, and descent into the scrotum in the breeding season, but thereafter ascent into the abdominal cavity, and become reduced and inactive. In a few cases (elephant, whale, seal) the testes remain permanently in the abdomen as the body temperature is low enough for sperm maturation. Scrotum is absent in such cases. Scrotum is in front of penis in Kangaroo.

(b) **Testes :** The testes are the primary sex organs. They are about $4 - 5 \ cm \log 2.5 \ cm$ wide and 3 *cm* thick. They are suspended in the scrotal sacs by spermatic cords.

(1) **Protective coats (Tunicae) :** Each testis has three coverings – tunica vaginalis, tunica albuginea and tunica vasculosa. On one side each testis is covered by hollowed tunica vaginalis, a bilayer of peritoneum with a narrow coelomic cavity having coelomic fluid for sliding. The actual covering of testis is a fibrous connective tissue sheath called tunica albuginea. Tunica albuginea also projects inside testis to form a vertical coloumn called mediastinum and a number of transverse septa.

(2) **Testicular lobules :** In growth of the tunica albuginea, called septa, divide the testis into some 200 to 300 lobules. Each testicular lobule contains 1 - 4 highly convoluted seminiferous tubules, blood

vessels and nerve embedded in loose connective tissue. A total of about 1000 seminiferous tubules occur in each testis. Each tubule is about 70 - 80 cm long. In seminiferous tubules lumen develop after puberty. The ends of the seminiferous



Fig. - T.S. A seminiferous tubule

tubules converge toward the middle of the posterior surface of the testis and join to form short straight tubules called tubuli recti. The tubuli recti open into a network of wider, irregular tubules called rete testis. Here some of the epithelial cells bear a single cilium to aid sperm transport.

Seminiferous tubules : Each seminiferous tubules is lined by germinal epithelium, seminiferous tubules is the site of spermatogenesis. The process occurs in waves along the length of the tubule, taking about 9 weeks (63 days) to complete in man. Seminiferous tubules contain 2 types of cells –

(i) **Germ cells :** These are spermatogenic cells by mitotic divisions, produce spermatogonia into the lumen of the seminiferous tubule. The spermatogonia grow into primary spermatocytes which undergo meiosis, producing haploid cells, first secondary spermatocytes and then spermatids. Spermatids differentiate by a process of spermiogenesis into dimorphic haploid sperm (containing X or Y chromosome). Mature spermatozoa lie free in the cavity of the seminiferous tubules.

(ii) **Somatic cells / Sertoli cells / Sustentacular cells / Nurse cells :** These are supportive nutritive and secrete a polypeptide hormone called inhibin and a steroid estradiol which interferes with spermatogenic activity and kinetics of sperm production.

□ These are scattered irregularly between spermatogonia.

□ They also phagocytose damaged germ cells and secrete enzymes for sperm maturation.

□ Rest on the basement membrane of the seminiferous tubule and its cytoplasm fills all the narrow spaces between the cells of the spermatogenic series. They have ovoid nucleus; exhibits deep identation and has large nucleolus. It has mitochondria, rough endoplasmic reticulum, and lipid droplets.

□ Sertoli cells is the characteristics of mammalian testis.

□ Sertoli cell acts as 'Nurse cell' and provide mechanical and metabolic support to developing germ cells.

□ These cells mediate some important regulatory processes. Sertoli cells produce androgen binding protein (ABP) which serves as vector for androgen and thus generate a hormonal milieu synergistically with FSH to facilitate spermiogenesis.

□ They do not divide and thus their number is constant.

□ They are resistant to exogenous / endogenous challenges.

(3) Leydig cells (= Interstitial cell)

(i) These are endocrine cell of testes which lie in the form of clusters or singly in the interstitum (=space between seminiferous tubules).

(ii) They are stimulated by LH (=ICSH) elaborated by luteotroph cells of adenohypophysis which themselves are triggered into activity by LHRH.

(iii) Leydig cells secrete a sex steroids called androgen by using cholesterol. The cells contain a rich repertoire of enzymes which facilitate formation of pathways for steroid biosynthesis and biotransformation. These enzymes are called steroid-dehydrogenases.

(iv) Leydig cells are large, have voluminous eosinophilic cytoplasm, lipid, vacuoles. In humans (but in no other species) they contain elongated cytoplasmic crystals called crystals of Reinke.

(v) Testosterone is the principal androgen. It acts in tandem with FSH to promote spermiogenesis. During pubertal changes it plays a critical anabolic role. It facilitates differentiation of secondary sex characters (change of voice, development of penis, spermatogenic activity, formation of facial hair/beard, pubic and axillary hair, moods, libido etc.)

Rete testis : This is a plexiform arrangement (Network) of space supported by highly vascular collagenous connective tissue. It is lined by cuboidal epithelial cells some of which bear flagella whose activity assists in forward migration of testicular sperm (which are immotile at this stage).

□ The seminiferous tubules open into rete testis.

(c) Vasa efferentia : Rete testis is connected to caput epididymis by 12 - 20 fine tubules called vasa efferentia or ductuli efferentes. Their lining epithelium is ciliated for conducting sperms.

□ Tubuli recti, rete testis and ductuli efferents constitutes an intertesticular genital duct system. The cells of vasa efferens are columnar ciliated.

(d) **Epididymis :** On the inner wall of the testis, a highly coiled tubule is present called the epididymis. They are two long (4 - 6 m), narrow (0.4 mm) tubules which lie compacted along the testes from their upper ends to lower back sides.

Epididymes has 3 parts

(1) Upper part (Heads) : Caput epididymis or globus major.

(2) Middle part : Corpus epididymis or globus normal.

(3) Basal part (Tail) : Cauda epididymis or globus minor.

 \Box In the head of epididymis, the sperms undergo physiological maturation, acquiring increased motility and fertilizing capacity. Then they pass down into the tail of the epididymis where they are stored for a short period before entering the vas deferens.

 \Box In epididymis the sperms are stored for a few hours to a few days till sent out through ejaculation.

□ Spermatozoa are produced whether ejaculation takes place or not.

□ The spermatozoa not ejaculated are reabsorbed in the vas deferens.

 \Box The epididymis shows peristaltic and segmenting contraction at intervals to push the spermatozoa away from the testis.

D Testis and epididymis are together called testicle.

(e) **Vasa deferentia** (Singular-vas dererens) : The vas deferens is a continuation of the cauda epididymis. It is about 40*cm*. long and is slightly coiled at first but becomes straight as it enters the abdominal cavity through the inguinal canal. Here, it passes over the urinary bladder, curves round the ureter and joins the duct of a seminal vesicle to form an ejaculatory duct. Near its end, the vas deferens is enlarged to form a spindle-like ampulla for the temporary storage of spermatozoa. At its distal end the ampulla receives a duct from seminal vesicle.

□ Vasa deferentia (ducti deferentes) conduct sperms from epididymis to urethra.

□ Surgical interference (vasectomy) of vas deferens ensure successful non-reversible male contraception.

S.No	Vasa efferentia	Vasa deferentia	
•			
1.	Arise from the	Arise from the cauda	
	rete testes.	epididymides.	
2.	Vary from 15 to	Are only 2 in number.	
	20 in number.		
3.	Are fine and	Are thick slightly	
	convoluted	coiled in the scrotum,	
		straight in the	
		abdomen	
4.	Lining bears	Lining has sterocilia	
	many ciliated	on many cells.	
	cells.		
5.	Carry	Carry spermatozoa	
	spermatozoa	from cauda	
	from rete testes	epididymides to	
	to caput	ejaculatory ducts.	
	epididymides		

Difference between Vasa efferentia and Vasa deferentia

(f) **Ejaculatory ducts :** They are short (2 *cm*) straight muscular tubes each formed by union of a vas deferens and duct of seminal vesicle where ejaculate is formed by mixing of sperms with secretion of seminal vesicle. The two ejaculatory ducts join the urethra within prostate gland.

(g) **Urethra :** It is the urinary duct leading from the bladder. From the point it is joined by ejaculatory ducts, it carries urine as well as spermatozoa and secretions of the seminal vesicles. It also receives secretion of the prostate and cowper's glands. Urethra is some 20cm long and passes through the penis. The urethra has 4 regions -

(1) Urinary urethra : It carries only urine.

(2) **Prostatic urethra :** It is a short proximal part which is surrounded by prostate gland.

(3) Membranous urethra : It is a short middle part, without any covering.

(4) **Penile urethra :** It is a long distal part that passes through the penis.

□ The penile part is also called spongiose urethra because it lies inside corpus spongiosum.

□ Epididymis, vasa deferentia and urethra transport sperms towards penile meatus or passage. They are collectively called excretory genital ducts.

□ The urethra opens out at the tip of the penis.

□ The urethra has 2 sphincters : Internal sphincter of smooth muscle fibres at its beginning and external sphincter of striated muscle fibres around its membranous part.

(h) **Penis :** The penis is an erectile copulatory organ. It consist of a long shaft that enlarges to form

an expanded tip, the glans penis. It is covered by a loose, retractable fold of skin, the prepuce or foreskin. Under the skin, the penis contains three columns of erectile tissue : two cylinders of the corpora cavernosa of the penis, placed dorsally, and one cylinder, the corpus spongiosum, along the ventral side. The corpora cavernosa of the penis and the urethra are covered by dense connective tissue, the tunica albuginea. Both urine and semen are carried out of the body through the penis.



□ Prominent blood vessels are present in these erectile tissue. These vessels are thick walled and have arteries and arteriole called helicine arteries (since they follow a spiral course in flaccid state). During erection dilation of these vessels causes enlargements of corpora cavernosum.

□ Penis is made up of fibrous connective tissue endoskeleton is absent in it. But in penis of some animals a bone is present called Baculum and such penis is called Osso-penis. Example – Whale, Bat,

Rat, etc.

□ The penis of opposum, bandicoot etc. is doubled branched.

Sperm storage : Sperms are stored for the most part in the vasa efferentia, epididymes and proximal parts of vasa deferentia.

(ii) Accessory sex glands : The substances secreted by the accessory, sex glands help in reproduction these are -

(a) Seminal vesicles : The seminal vesicles are long pouches with muscular wall; they secrete spermatozoa activating substances, such as fructose, citrate. inositol, prostaglandins and several proteins, sperms use fructose as а respiratory substrate. Seminal fluid maintains viability and motility of sperms.



□ Seminal vesicle secretes a nutritive fluid which forms main part *i.e.* 60 - 80% of the semen.

 \Box It is also called uterus-masculinus. It forms from the mullerian duct of the embryo. In females, these ducts form the ovi-ducts.

□ The seminal vesicle do not store sperms.

□ Seminal vesicles are found between urinary bladder and rectum.

Test for rape : Fructose, which is present in the seminal fluid and is not produced anywhere else in the body, provides a forensic test for rape. Its presence in the female's genital tract confirms sexual intercourse.

(b) **Prostate gland :** The prostate gland surrounds the first portion of the urethra. This gland secretes an alkaline fluid which forms 15 - 30% part of the semen. The secretion nourish and activates the spermatozoa to swim. It is essential for sperm motility (removal causes sterlity).

□ In the secretion of prostate–gland citric acid, calcium and phosphate, Fibrinogen and Fibrinolysin is present. The secretion of the prostate gland combines with the secretion of seminal vesicle and so the semen gets coagulated. In the coagulated semen, the mobality of sperms is reduced and so their energy is conserved. After sometime due to fibrinolysins, semen again liquefies and in this semen now the sperms can move.

(c) **Cowper's glands :** These are also termed as Bulbourethral glands. 1st pair of Cowper's glands are attached to urethra. They secrete alkaline mucus which is discharged into the membranous part of urethra. The mucus lubricates the reproductive tract. This serves to neutralize any acid of urine remaining in the urethra. Secretion of Cowper's glands is produced before the ejaculation of semen.

Secretion of Cowper's glands carries some spermatozoa released before ejaculation. This is one of the reasons for the high failure rate of the withdrawal method of birth control.

(d) **Perineal or Rectal glands :** These are found both in males and females during the breeding season, these glands secrete and odoriferous liquid which has pheromones or Ectohormones in it. Its smell attracts the animal of opposite sex.

Note : In man, Perineal or Rectal glands are absent.

(e) **Other glands :** Prepuce contains preputial glands which produce a sebaceous substance which together with desquamated epidermal cells forms a whitish, pasty, foul-smelling accumulation, called smegma, about the base of the glans penis beneath the prepuce.

(iii) **Semen :** The products of the testes (spermatozoa) and prostate gland, alongwith fluid from the seminal vesicle, are collectively knows as semen. Release of spermatozoa from urethra is known as ejaculation.

□ It is a milky, viscus and alkaline (pH 7.3 – 7.5) fluid ejaculated by male reproductive system during orgasm. The volume of ejaculate varies from person to person. Abstinence play a role in this. Each ejaculate measures 3.5 ml and contains 50 – 150 million sperm/ml *i.e.* 250 million – 525 million (average – 400 million).

□ Nearly 25% of these sperms have abnormal shapes, lack motility. The life span of human sperm after ejaculation is 24 - 48 hrs. Crayopreservation enhances the longevity of sperm. The rate of active moment of sperm is 1.5 - 3.0 mm per minute in uterine endometrium.

□ Semen has chemicals for nourishing the sperms (*e.g.* – fructose), neutralizing the acidity of urethra and vagina (*e.g.* – bicarbonate), stimulating movements in female tract (*e.g.* – prostaglandins). *pH* of semen – 7.35 - 7.55.

□ Testicular sperm cannot fertilize ovum. They undergo maturational changes in epididymal segment and acquire fertilizing ability (capacitation). However, these sperm are masked by decapacitation factor (protein) when deposited in vagina of female, this mask is dissolved and they reacquired fertilising ability (second phase of capacitation).

A person with a sperm count below 20 million will be physiologically sterlile. Fusion of defective sperm (*e.g.* 22+xy) with ovum causes many birth defects *e.g.* klinefelter's syndrome.

□ Penis conducts urine as well as semen. But the two cannot pass through it at the same time.

□ Sperm can survive in the female reproductive tract for 1 to 3 days.

Hormonal (iv) control of male reproductive : The growth, system maintenance and functions of secondary sex organs (epididymis, vasa deferentia, accessory glands and penis) are under the control of testosterone hormone secreted by Leydig's cells of testis, while those of seminiferous tubules and Leydig's cells are controlled by Follicular Stimulating Hormone (FSH) and Interstitial Cells Stimulating Hormone (ICSH) of anterior pituitary lobe respectively.

Sertoli cells also secretes two proteins

(a) Androgen Binding Protein (ABP) that concenterates testosterone in the seminiferous tubules.





(b) (Inhibin) protein which suppress FSH secretion. Release of FSH, LH or ICSH, in turn, are controlled by release of hypothalamic gonadotropin releasing hormone (GnRH).

(v) **Onset of puberty in the male :** Puberty is the period when reproductive organs become functional. It is triggered by the secretion of the hormone testosterone in the testes. This hormone brings about growth and maturation of the secondary sex organs and development of the accessory sex characters. The latter induce –

(a) Enlargement of the penis and scrotum.

(b) Broadening of the shoulders.

(c) Growth of body and facial hairs.

(d) Deepening of the voice duce enlargement of layrnx and thickening of vocal-cords.

(e) Increased development of musculature and bones.

(f) Increase in height so characteristic of male puberty.

(vi) **Male sex act :** The male sex act involves 3 phases : erection of the penis, copulation (often called sexual intercourse in humans) and subsidence of erection.

(a) **Erection :** Erection of the penis is caused by rush of arterial blood into the empty sinuses of its spongy tissue on sexual excitement. As the spongy tissue distends, it compress the veins, inhibiting the flow of blood out of the tissue. Filling of tissue with blood is called vasocongenstion. Erection makes the penis long and stiff for entry into the female's vagina for copulation. Stiffness is due entirely to the hydraulic pressure of blood filling the sinuses.

(b) **Copulation :** Mucus from the urethral glands, Cowper's glands and vaginal glands provides lubrication for copulation. Friction due to rhythmic movements of sexual intercourse stimulate the sensory cells of the glans penis. This stimulation releases semen into the proximal part of urethra by contraction of reproductive glands and ducts. This process is called emission. Then the rhythmic, wavelike contractions of the muscles at the base of the penis cause forceful discharge, called ejaculation, of semen into the vagina. One ejaculate (about 3 *ml*.) contains 200 to 400 million spermatozoa. Ejaculation marks the climax of copulation.

Orgasm : At the peak of sexual stimulation, pleasurable sensation, called orgasm, occurs. It usually last only a few seconds.

(c) **Subsidence of erection :** After ejaculation, the arterioles to the penis contract, reducing the blood flow to the penis, and erection subsides. This often takes a few minutes.

(vii) **Movement of spermatozoa to site of fertilization :** In the female genital tract, alkalinity of the semen helps neutrilize acidity in the vagina. This protects the sperms and increase their motility,

prostaglandins of the semen thin the mucus at the opening of the uterus, and also stimulate contractions of the uterine muscles. These contractions help the semen move up the uterus called syring absorption mechanism. When ejaculated, the semen first coagulates, making it easier for uterine contractions to push up; and is



Fig – Human female

then liquefied by the anticoagulating enzymes, enabling the sperms to start swimming in the uterus. From here, they reach the oviduct. In the oviduct, the spermatozoa are capacitated (attain the ability to penetrate the ovum). Somewhere in the ampulla of the oviduct, an ovum, if present, may be fertilized by a sperm, and procreation of the special starts.

(viii) **Disorders of male reproductive system :** Only a few are mentioned.

(a) **Prostatomegaly (Prostatic hypertrophy) :** This is enlargement of prostate gland. If often occurs in old age. The enlarged gland may block the urethra, causing frequent night urination (nocturia) or difficult or painful micturition. Prostate cancer is very common in men. It is treated surgically or with drugs.

(b) **Impotence :** This is inability of the male to achieve and or maintain erection of the penis long enough to engage in or complete copulation.

(c) **Sterility :** Inability of the male's sperm to fertilized the ovum, it may or may not be associated with impotence. Sterility also results from immobility and morphological abnormality of the sperms, and from low sperm count in the semen.

8.3 FEMALE REPRODUCTIVE SYSTEM

The female reproductive system consists of a pair of ovaries, a pair of fallopian tubes, uterus, vagina, external genitalia or vulva and breasts.

(i) Reproductive organ

(a) **Ovaries :** Ovaries are the primary sex organs of female.

(1) **Size and form :** The ovaries are almond shaped bodies, about 3 *cm* long, 1.5 cm wide and 1 *cm* thick.

(2) **Role :** The ovaries, like the tests, have both an exocrine function (production of ova) and an endocrine role (secretion of female sex hormones : estrogen and progesterone). After menupause, the ovaries become small and lose follicles.

(3) Location : Each ovary is located close to the lateral walls of the pelvic cavity, being suspended

from the dorsal body wall just behind the kidney, by a section of peritonium, the mesovarium. It is held in position by several connective tissue ligaments. Each ovary is connected by an ovarian ligament to the uterus, and by a suspensory ligament to the lateral pelvic wall. It has hilus where nerves and blood vessels are connected.

(4) **Structure :** Each ovary is a compact or solid organ, consisting of an



outer cortex and inner medulla. The stroma of the cortical region is composed of spindle shaped fibroblasts. A poorly delineated dense connective tissue layer, the tunica albuginea, covers the cortex. It imparts the whitish colour to the ovary. Located outside the tunica albuginea, the germinal epithelium, formed of simple squamous or cuboidal epethelial cells, covers the surface of the ovary.

Cells of germinal epithelium give rise to groups of oogonia that project into cortex as cords called egg tubes of Pfluger, each with a round terminal mass of oogonia called egg nest. Egg nests give rise to ovarian follicles. In neonate female baby the ovary contains about 2 million follicles but 50% of them are attretic or degenerate. Atresia continues and by the time of puberty some 3,00,000 - 4,00,000 ovarian follicles are present in an ovary. However, only 450 ovarian follicles mature, one by one alternately in the two ovaries at intervals of 28 days. A mature ovarian follicle is called Graffian follicle. It has a diameter of 10 *mm*. Outer fibrous theca externa and inner cellular theca interna are derived from spindle cells of cortex. Estrogen secreted by the internal theca of graffian follicle. Other constituents are follicular cells (nourishing cells formed from undifferentiated oogonia), an antrum or follicular cavity having liquor folliculi and an eccentrically placed oocyte. Follicular cells form a cellular sheath (below theca interna) called membrane granulosa and cellular mass called cumulus ovaricus covering the oocyte. Cumulus oophorus or cumulus ovaricus differentiates into outer discus proligerous and inner corona radiata. Alongwith oocyte it also secretes a mucoprotein membrane called

zona pellucida. Oocyte (secondary oocyte with metaphase of meiosis II) is $50 - 100 \mu m$. It is microlecithal (alecithal according to some workers). Oocyte membrane is called vitelline membrane. There are three coverings around the egg – inner zona pellucida, middle corona radiata and outer discus proligerous. A polar body is found between viteline membrane and zona pellucida. Graffian follicle develops under influence of FSH of anterior pituitary. Its follicular cells secrete estrogen. Estrogen brings about proliferation of lining layer of uterus, vagina and fallopian tubes. Rising level of estrogen decreases





production of FSH and stimulates secretion of LH. The two cause the mature Graffian follicle to rise to the ovarian surface and burst open releasing ovum (ovulation). It occurs 10 - 14 days of mestrual cycle. The empty ruptured Graffian follicle is called corpus haemorrhagic. It usually contains a blood clot. The ruptured follicle shows proliferation of cells of membrana granulosa, deposition of yellow pigment or luteum and formation of yellow body called corpus luteum. It grown in size to about 2.5 *cm*. Corpus luteum secretes progesterone Ultimately corpus luteum loses its yellow colour, becomes changed to corpus albicans and then degenerates. Some thecal cells located around the follicle become active interstial cells which secrete small amount of androgen.

(b) **Fallopian tubes / Uterine tubes / Oviducts :** Each ovary is located in front of a funnel shaped opening of the uterus, the oviduct. The oviduct is a muscular tube, measuring about 12 cm in length. Its lumen is lined by ciliated epithelium.

• Oviducts develop from the mullarian duct of the embryo.

 \Box It conveys the egg from the ovary to the uterus, and provides the appropriate environment for its fertilization.

□ It is supported by a double fold of peritoneum called mesosalpinx.

□ The wall of oviduct is made of three layers –

(1) **Serosa :** It is the outermost layer of visceral-peritoneum.

(2) **Muscle-layer :** The middle layer of the oviduct is made up of unstriped-muscle.

(3) **Mucous membrane :** It is the innermost layer. This layer is made up of ciliated epithelium and the connective tissue.

The oviduct shows 4 regions –

(i) **Infundibulum :** It is the broad, funnel-shaped proximal part. Its margin bears motile, finger-like processes called fimbriae. It opens into the body cavity by an aperture called ostium. The latter lies close to the ovary to receive the egg released from the ovary. The fimbriae bear cilia which beat toward the ostium to direct the egg into the infundibulum.

(ii) **Ampulla :** It is the long, wide, thin-walled, tortuous major part of the fallopian tube next to the infundibulum.

(iii) Isthmus: It is the very short, narrow, thick-walled, straight part that follows the ampulla.

(iv) Uterine part : It is also narrow and passes through the uterine wall, and communicates with the uterine cavity.

□ The oviduct is ciliated usually in its ampullary portion. Eggs are propelled along the oviduct by peristaltic and ciliary action.

□ The oviducts open into the upper corners, the cornua (singular-conru), of the uterus.

In most vertebrates both the ovaries and oviducts are functional. In birds the right ovary and right oviduct are atrophied (Degenerated). Being nonmammalian, the birds also lack mammalian sex organs and characters like uterus, external genitalia and mammary glands.

(c) Uterus

(1) **Structure of uterus :** It is pyriform, hollow muscular thick-walled but distensible median structure located above and behind urinary bladder that is meant for nourishing and development of foetus. For this uterus is capable of tremendous enlargement. The empty uterus is 7.5 cm long and 5 cm broad and 2.5 cm thick. Lining layer of uterus, called endometrium (mucous membrane), consists of an epithelium and lamina propria of connective tissue. Epithelium is a mixture ciliated and secretory columnar cells. Lamina propria contains tubular glands, fibroblasts and blood vessels.



Fig. – Female

□ It is attached to the body wall by a double fold of peritoneum, the mesometrium (broad-ligament). It varies in size. In a nulliparous woman (who has not borne any child), It is about 8 cm long, 5 cm wide and 2 cm thick. It is some what larger in a multiparous woman (who has borne two or more child).

It has four regions -

(i) Upper wide, domeshaped fundus that receives the fallopian tubes.

(ii) Cornua, the upper corners where the oviducts enter the uterus.

(iii) Middle large body or corpus which is the main part.

(iv) Lower narrow cervix that projects into the vagina. The cervix communicates above with the body of the uterus by an aperture, the internal os, and with the vagina below by an opening, the external os.

The line demarcating the body and the cervix is called isthmus. It corresponds to the internal os.

The uterus has a thick, highly vascular wall composed of three tissues : outer peritoneal covering called perimetrium, middle smooth muscle layer termed myometrium, and inner mucous membrane known as endometrium. Longest unstriped muscles of the body are found in the walls of uterus.

(2) Antiflexion : The normal position of the uterus is anteflexed, that is, it is bent forward on itself at the level of the internal os so as to lie almost horizontally over the bladder. The cervix is composed largely of the biggest and the most powerful sphincter muscle in the body. It is strong enough to hold about 7 kg. of foetus and fluid in the uterus against the pull of gravity during pregnancy.



Fig. – Female external

(3) **Capacity of uterus :** The cavity of the Fig. uterus can expand 500 times during pregnancy, from $10 \text{ } cm^3$ to 5,000 cm^3 .

(4) Types of uterus

(i) **Duplex :** These are the simplest type of uteri. In it both the uteri are completely separated and open independently into the vagina through two separate openings *e.g.* Rat.

(ii) **Biparite :** In these uteri, the lower part of the two uteri are fused and there is a septa in between the two, *e.g.*, Carnivore mammals.

(iii) **Bicornuate :** The lower parts of the 2 uteri are fused with each other but the partition wall is absent, *e.g.* Rabbit.

(iv) **Simplex :** When both the uteri are completely fused with each-other to form only one structure, these are the most developed uteri e.g. Man.

(5) **Functions of uterus :** The uterus plays multiple role. It receives the ovum from the fallopian tubes, forms placenta for the development of the foetus and expels the young one at birth.

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(d) **Vagina :** It is tubular female copulatory organ, passageway for menstrual flow as well as birth canal of about $7 - 9 \ cm$ length between external opening (vaginal orifice) in vestibule and cervix with depression or fornix around cervix, two longitudinal ridges and numerous transverse folds or vaginal rugae. Vaginal wall is made of an internal mucosa, muscular layer and an outer adventitia. Its mucous membrane is nonkeratinised stratified squamous epithelium. Glands are absent. However, cervical glands do pass on some mucus into it during ovulation. the epithelial cells contain glycogen (from puberty to menopause) which shows cyclic changes. Certain bacteria (species of Lactobacillus and Lactoneustroc, also called Doderlein's Bacillus) bring about fermentation and produce acid which inhibits growth of other microorganisms. In virgins the vaginal orifice is partially covered by an annular centrally perforate membrane called hymen.

(e) **External genitalia / vulva :** There is a depression, the vestibule, in front of the anus. It is flanked by two pairs of fleshy folds of skin : the inner small, thin, moist, labia minora and outer larger, hair-covered labia majora. All the labial folds have numerous sebaceous and sweat glands on both sides. A small erectile organ, the clitoris, lies at the anterior junction of the labia minora. It is homologous to the penis in the male but is very small and solid, having no passage through it. It consists of a short shaft with erectile tissue. It ends in a rounded glans clitoridis. The latter is covered by a small hook of skin, the prepuce. Rubbing of clitoris during intercourse produces a pleasurable sensation. This seems to be its only function. A membranous fold, called fourchette, connects the posterior ends of the labia minora. The area between the fourchette and the anus is termed perineum. Urethra and vagina open by separate apertures, the upper urethral and lower vaginal orifices, into the vestibule. The vaginal orifice is normally covered in the virgin by a membrane, the hymen. A slit in the hymen allows menstrual flow to pass out. The hymen is ruptured during first copulation, or due to some other reason. The hymen presumably has a protective role, but is absent in many women. A fleshy elevation above the labia major is known as mons veneris or mons publs. It bears public hair.

(f) **Bartholins or vestibular glands :** They are a pair of small glands which open in the vestibule lateral to vaginal orifice. The secretion is thick, viscid and alkaline for lubrication and counteracting urinary acidity (similar to Cowper's glands in males).

(g) **Breasts / Mammary glands :** The breasts are rounded eminences located over the pectoral muscles on the front wall of the thorax. These enlarge considerably in the adult female. Each breast has

near its middle a nipple surrounded by a circular, pigmented (deep pink to brown) area called areola. The breasts contain fatty and connective tissues and mammary (milk) glands. The latter are compound saccular glands and are modified sweat glands. The connective tissue supports the mammary glands and the adipose tissue covers them. The glands open on the nipples, the lactiferous ducts. Just under the nipples, the lactiferous ducts widen to form lactiferous



sinuses, to store milk during lactation. A nursing mother produces 1 to 2 litres of milk per day.

□ Milk secretion is under the control of prolactin (of anterior pituitary) while milk ejection is under control of oxytocin (of posterior pituitary).

□ First or premilk after parturition is called colustrum.

□ Each mammary gland consists of 15 - 25 lobules of the compound tubulo alveolar type. The lobules secrete milk.

 \Box In a nonpregnant woman, the glandular tissue is scanty. During pregnancy, the glands grow under the influence of oestrogen and progesterone. On the infant's birth, the hormone prolactin stimulates the production of milk and the hormone oxytocin causes release of milk as the infant sucks the breast. After menopause, the glands atrophy.

□ Rudimentary milk glands are present in the male also. Low level of estrogen in males checks the development of secretory tissue as well as fat deposits.

(ii) **Onset of puberty in the females :** Woman attains puberty about the age of 13. Its onset it triggered by the production of the anterior pituitary's follicle-stimulating hormone (FSH) which promotes growth of the ovarian follicles. The follicles then secrete the hormone estrogen from the follicle cells in the ovaries. This hormone brings about the growth and maturation of the reproductive tract and the development of accessory sex character. The latter include growth of breasts and external genitalia, broadening of pelvis, growth of pubic and axillary hair, increase in the subcutaneous fat, particularly in thighs, shoulders, buttocks and face to give a typical feminine contour and initiation of menstruation and ovulation.

(iii) Hormonal control of female reproductive system : Ovary is regulated by pituitary gonadotropins or G_nRH . Anterior pituitary secretes follicular stimulating hormone (FSH) which controls of the transformation of young primary follicle into Graffian follicle, maturation of ovum and secretion of estrogens by its follicular cells. The Luteinizing Hormone (LH) of anterior pituitary regulates the ovulation from the Graffian follicle, transformation of empty Graffian follicle into yellowish, conical corpus luteum and secretion of progesterone hormone from the corpus luteum.

Growth and function of secondary sex organs are regulated by estrogens and progesterone. Estrogens control the growth, maintenance 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.

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

(iv) **Reproductive cycle in female :** The events involved in reproduction in female mammals occur in a cyclic manner. Constituting the reproductive cycle or ovarian cycle. The reproductive cycle is of two types :

(a) Oestrous cycle (b) Menstrual cycle

Oestrous cycle : The oestrous cycle consists of a few days of oestrus or "heat" followed by a few days of anoestrus of "quiescence".

□ During oestrus, the female is sexually responsive, allows a male to copulate, eggs are released and pregnancy is possible.

During anoestrus, the female become passive and does not accept a male.

□ The oestrus occurs in most species of mammals. Many mammals reproduce in the breeding season only. The oestrus cycles run only during the breeding season in these mammals and anoestrus spreads over the entire non breeding season.

□ Except primates, oestrous cycle is found in all mammals.

□ Some mammals, such a cow and buffalo experience oestrous cycles throughout the year. They have no specific breeding season.

□ In rabbit the oestrous cycle is of 7 days.

• Oestrous cycle of rat is of 5 days only.

Dog has one cycle per year.

□ Oestrous is also found in the new-age monkeys.

□ During the oestrous-cycle, the wall of uterus does not dissolve *i.e.* no bleeding takes place.

□ Mono – oestrous animals : In the breeding

period of some animals only one oestrous cycle is present. e.g. Rabbit, Hare, Dog, Fox, Bat, Deer etc.

 \Box Poly – Oestrous animals : In many animals many oestrous cycles are found in the breeding period. *e.g.* – Rats squirrels, Cow, Sheep, Pig, Horse etc.

(b) **Menstrual cycle :** The gamete formation in females is a cyclic activity that takes about 28 days and involves changes in the structure and function of the entire reproductive system. It is called menstrual cycle.

□ The menstrual cycle occur only in primates.

(1) **Period :** The length of menstrual cycle varies widely in women, but on average it is completed in 28 days (mensem means a month). In a female, successive cycles may vary in length by 1 to 2 days. It is absent during pregnancy, may be suppressed during lactation and permanently stops at menopause.

(2) Phase : Menstrual cycle is divided into four phases -

(i) Follicular (Proliferative) phase or Post-menstrual or Pre-ovulatory phase : It follows the menstrual phase and lasts for about 10 - 12 days (from 5th to 14th day of menstrual cycle). It involves following changes :

(a) Under the stimulation of FSH-RF of hypothalamus, there is increased secretion of FSH from anterior pituitary.

(b) FSH stimulates the change of a primary follicle of the ovary into a Graffian follicle.

(c) Follicular cells of Graffian follicle secrete estrogens. Estrogens have the following effects :

(1) Stimulate the growth, maintenance and normal functioning of secondary sex organs.

(2) Uterne endometrium becomes thick (about 2-3 mm thick), more vascular and more glandular cork-screw shaped. So it prepares itself for implantation.

(3) The epithelium of Fallopian tubes becomes thick and densely ciliated to conduct the ovum / zygote.

(4) Inhibit the secretion of FSH and stimulate the secretion of luteinising hormone (LH) from the anterior pituitary.

(5) Glycogen and fat accumulate in the endometrial cells.



(ii) **Ovulatory phase or fertility phase :** It involves the ovulation from the Graffian follicle of ovary. The mature graffian follicle rises to the surface of the ovary and ruptures to release ovum. The phenomina is called ovulation. It occurs midway between two menstrual cycles on 14th day of the onset of the menstrual cycle. it is caused by increasing turgidity and contraction of smooth muscles fibres around the Graffian follicle. Ovum is received by the fimbriad of the fallopian tube. Ovum is viable for two days. Ovulation is controlled by the increased level



of LH in the blood. Egg at that time is in the secondary oocyte state. LH also starts the change of empty

Graffian follicle into corpus luteum and secretion of progesterone from corpus. There is no much change in uterine endometrium during ovulatory phase. In animals the ovulation follow three patterns –

(a) **Fix or spontaneous ovulators :** In these animals ovulation takes place a fix time in the midway of cycle. There is no need of coitus for ovulation. *e.g.* Primates (Human, Ape and Monkey)

(b) **Induced or reflex ovulators :** In these animals copulation or ciotus is necessary for ovulation. e.g. - Rabbit.

(c) **Seasonal ovulators :** Ovulation occur in breeding season e.g. - Frog.

(iii) Luteal or progestational or Premenstrual or Secretory or Post-ovulatory phase : It lasts for about 12 - 14 days and extends from 16^{th} to 28^{th} day of menstrual cycle. It is characterised by following changes –

(a) **Corpus luteum (Yellow body) :** Formed from empty Graffian follicle, increase in size, so is called luteal phase.

(b) Corpus luteum begins to secrete hormone called progesterone. The latter reaches its peak about 22^{nd} day after the beginning of cycle.

□ Progesterone induce following changes –

(1) Decreases the secretion of FSH and LH (gonadotropins) from anterior pituitary so inhibits the maturation of follicle and ovulation.





(2) Uterine endometrium further proliferates (about 5 mm thick) and is ready for implantation. Uterine glands secrete Uterine milk for the foetus.

(3) Reduces the uterine movements.

□ In the absence of fertilization, corpus luteum degenerates LH levels falls. Progesterone level is reduced. Reduced level of both progesterone and estrogen causes mensus.

(iv) **Menstrual phase or bleeding phase :** It lasts for about 3-5 days and extends from 1st to 4th day of the menstrual cycle. When the ovum remains unfertilized, then the corpus luteum starts degenerating. The level of progesterone in the blood declines. The uterine tissues fail to be maintained. Then the unfertilized ovum along with ruptured uterine epithelium, about 50 - 100 ml of blood and some mucus is discharged out through the vaginal orifice and is called menstrual flow or menstruation.

Decrease in the level of progesterone and estrogens in the blood stimulates the hypothalamus and anterior pituitary to release FSH-RF and FSH respectively (Positive feedback). FSH starts the follicular phase of next menstrual cycle.

(3) **Effect of fertilization :** If fertilization occurs and foetus is implanted in the endometrium, the trophoblast cells of the developing placenta secrete a hormone human chorionic gonadotrophin (hCG). This hormone, like LH, maintains the corpus luteum and the secretion of progesterone and estradiol by it. These two hormones check the breakdown of the endometrium of the uterus. the absence of

menstrual bleeding (the 'period') is the earliest sign of pregnancy. By the 16th week of pregnancy, the placenta produces enough progesterone and estradiol for a normal pregnancy, and the now unnecessary corpus luteum undergoes shrinkage.

(4) **Miscarriage :** Prematured egeneration of corpus luteum is the common cause of miscarriage at about 10 - 12 weak of pregnancy (miscarriage means abortion)

(5) Menopause (Climacteric period)

Definition : It is the period when ovulation and menstrual cycle stop in human female.

Period : Between 45 to 55 years. The average period of menopause is currently 52 years. In some, this occurs gradually (in between a period of 1-5 years) while in some this occur abruptly.

Characters : Menopause is characterized by hot flushes (sensation of warmth spreading from the trunk to the face) and a number of psychic symptoms. FSH is secreted in the urine.



Cause : Decline in the estrogen level.

Note : \Box The function of the testes declines slowly with advancing age, especially in their late 40 yrs or 50 yrs due to decrease in testosterone secretion and is called male climacteric.

(v) Disorders of female reproductive system

(a) **Sterlity :** Inability of the female to conceive, due to inadequacy in structure or function of the genital organs.

(b) Menstrual irregularity

(1) Amenorrhoea : Absence of menstruation.

(2) Hypermenorrhoea : Excessive or prolonged bleeding of uterus.

(3) **Dysmenorrhoea :** Painful menstruation.

(vi) **Pregnancy test :** During pregnancy, HCG may be detected in the urine, and this forms the basis of pregnancy test.

□ Oral contraceptive checks ovulation and implantation (for more information see endocrine system).

8.4 GAMETOGENESIS

The process of the formation of haploid gametes from the undifferentiated, diploid germ cells in the gonads for sexual reproduction is called gametogenesis.

□ As a result of this process, male gamete sperm and female gamete egg is formed.

□ The process of Gametogenesis is stimulated by the FSH or Follicle Stimulating Hormone and for this process Vitamin "A" and "E" are also necessary.

□ The process of Gametogenesis has been divided into 3 substages –

(1) Multiplication phase.

(2) Growth phase.

(3) Maturation phase.

Types of gametogenesis

(i) Spermatogenesis

□ The process of formation of sperms in the germinal-epithelium of the testis of the male animal is termed as spermatogenesis.

□ In mammals, testis have several coiled tubules in it called the seminiferous tubules.

□ Sperms are formed in these tubules. The inner wall of seminiferous tubules is made up of germinal epithelium whose cells are cuboidal.

□ Some special cells are present in this germinal epithelium which are called the primordial germ cells. Due to the division of these cells sperms are formed.

□ Some large cells are also found in this germinal epithelium. These are called the "Sertoli cells or Subtentacular cells".

□ These cells provide nutrition to the maturing sperms in the form of Glycogen.

□ For getting nutrition, the head of the sperms are submerged in the cytoplasm of sertoli cells.

□ When sperms fully mature, they move away from sertoli cells and get liberated in the cavity of seminiferous tubules.

□ Liberation of sperms from sertoli cells is termed as Spermiation.

□ Liberation of sperms from the testis is termed as Semination.

□ Liberation of sperms into the vagina of the female is termed as Insemination.

□ Sertoli cells are also endocrine in nature and they secrete 2 hormones –

AMH (Anti Mullarian Hormone) : This hormone stimulates degradation of female gonads in a male embryo.

Inhibine hormone : This hormone is secreted in adult stages and it stops the secretion or FSH.

 \Box Sertoli cells mainly provide nutrition and conserve the various stages of spermatogenesis. Spermatogenesis is a continuous process. To make it easier for study, it has been divided into the following steps –

(a) Formation of spermatid.

(b) Spermiogenesis or Spermatolesis.

(a) **Formation of spermatids :** This process begins as the animal attains sexual maturity. The cells of the germinal epithelium of the seminiferous tubules which participate in this process are termed as the primordial germ cells. The process of formation of spermatids from primordial germ cells are termed as spermatocytosis. It has 3 sub-stages –

(1) **Multiplication phase :** During this process the primordial germ cells repeatedly undergo mitosis division, and as a result of these divisions spermatogonia are formed spermatogonia are diploid.

(2) **Growth phase :** Some spermatogonia either due to growth or due to food storage become 2 or 3 times of their original size, and are now known as primary spermatocytes. The remaining spermatogonia remain in the seminiferous tubules in the form of reserved stock. The primary – spermatocytes formed during the growth phase are diploid. Growth phase is the longest.

(3) **Maturation phase :** Primary – spermatocytes undergo Meiosis-I and as a result 2 haploid secondary spermatocytes are formed. This division is termed as First Maturation Division or Reductional division. Secondary spermatocytes undergo Meiosis II or equational division, and as result, 2 spermatids are formed from each secondary spermatocyte. Thus, from 1 diploid primary spermatocytes 2 secondary spermatocytes are formed on meiosis I and from 2 haploid secondary spermatocytes 4 spermatids are formed on meiosis-II. Metamorphosis of spermatids into sperms in known as Spermiogenesis or Spermatoliosis.

(b) **Spermatoliosis :** The process of transformation of a round non-motile and haploid spermatid obtained from spermatocytosis into thread-like, motile and haploid sperm is termed as spermatoliosis. From different parts of the spermatid different parts of the sperm are formed. These are as follows –

(i) From nucleus and glogibody -> Head part

(ii) From mitochondria -> Middle part

(iii) From distal centriole -> Tail part.

(i) The structure of the head of the sperm mainly depends on the structure of the nucleus. During spermatoliosis, nucleus contracts and acquires different shapes.

□ RNA and nucleolus disappear from nucleus or their major part is given out from the nucleus. DNA also contracts / shrinks *i.e.* now the nucleus contains only those materials which are responsible for the hereditery characters.

□ Centrosome divides into 2 centrioles *i.e.* 1 distal and 1 proximal centriole.

□ Many golgi-bodies aggregate on the posterior side and their vacuoles enlarge.

□ In some vacuoles of the golgi-bodies. Some dense-bodies can be seen, which are termed as Acroblast.

□ In any one vacuole the Acroblast enlarges by aggregating with other. These are termed as "Acrosomal Granules".

□ The rest part of the golgi-body is given out and this is termed as Golgi-rest.

□ This acroblast reaches the anterior most tip of the sperm and acquires a cap shaped structure on the nucleus which is termed as the Acrosome.

□ Acrosome is surrounded by a double membrane i.e. the tonoplast and cell-membrane.

□ The acrosome along with this membrane is termed as Galea-capatis. Acrosome, at the tip of the nucleus has an important role in breaking the egg.

□ Mitochondria from different parts of spermatid, collect around the growing axonema and form a dense structure. In mammals, they form a spiral structure called Nebenkern sheath. In other animals, they collect and form mitochondrial clumps.

□ The part of the axonema surrounded by mitochondria is known as Middle-piece.

□ Around the middle-piece cytoplasm is present in the form of a thin layer called Manchette.

□ Behind the middle piece, axonema surrounded only by plasmalemma is present. This is called the tail part.

□ Shape of the sperm is so that it can move easily in a liquid medium.

□ Structures and functions of sperms parts –

(a) Acrosome : Breaking the egg

(b) Middle piece: For providing energy

(c) Tail : For locomotion

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Above structures are formed during spermatoliosis and the remaining substances are given out in the form of cytoplasmic residue, which is ingested by the "Cells of Sertoli".

(ii) Structure of sperm : Structure of sperm has three parts

(a) Head (b) Middle piece (c) Tail

(a) **Head :** It is flat ant oval in human sperm. It is composed of a large posterior nucleus and a small anterior acrosome.

Acrosome

 \Box Acrosome is formed from the golgi complex. It contains digestive enzyme "spermlysin". It is the caplike covering above the nucleus. It is surrounded by double membrane. Acrosome + its membrane are together called Galea-capatis. Acrosome plays important role in penetration of ovum by sperm.

□ Remaining part of the head is nucleus. Narrow space between the nucleus and the acrosome is termed as "perforatorium".

□ Nucleus of the sperm is very small. In it nucleoplasm and nucleolus are absent. It contains only chromatin.

□ At the base of the nucleus in a pit like depression proximal centriole is present.

□ In between the head and the middle piece a small neck is present. In this neck part a distal centriole is located. Both the centrioles are at right angles to each other.

□ Proximal centriole first induce cleavage in a fertilized egg. First spindle fibre forms from it.

□ Distal centriole gives rise to the axial filament of the sperm. It has (9+2) microtubular arrangement.

(b) Middle piece

□ This is known as the energy-chamber of the sperm. Many mitochondria spirally surround the axonema, this is called "Nabenkern sheath". This part provides energy to the sperm for locomotion.

□ In middle-piece, cytoplasm is found in the form of a thin-sheet called Manchett.

□ In middle-part, axonema is surrounded by 9 solid fibres made up of proteins.



At the posterior end of the middle-piece a Ring centriole is found. Its function is not known.
 (c) Tail

 \Box The longest and the fibrous part of the sperm is termed its tail.

□ Sperm moves with the help of its tail.

□ Basal granule of the tail is Distal centriole.

Tail has 2 parts

□ Main part : This part is broad. It contains cytoplasm and is surrounded by 2 solid fibres.

End piece : This part is narrow in it cytoplasm is absent only axonema is present. In it solid fibres are also absent. In the sperm of certain animals, tail is absent. *e.g.*

PHASE OF CHROMOSO

(1) Ascaris : Tailless, ameboid sperms

(2) Cray fish : Tailless, stellate (star shape) sperms.

(3) Crab and lobser : Tailless sperms with 3 spines at apex.

(4) Biflagellage sperms : In Toad fist (Opsanus)

(5) In Opposum : Many sperms fuse together by their heads to form a "sperm-boat".

(6) Gastrapods have hexaflagellated sperms.

(iii) Oogenesis : Oogenesis takes
place in the ovaries. Unlike sperm
formation that starts at puberty, egg
formation begins before birth but is
completed only after fertilization.
Oogenesis consists of three phases –

(a) Multiplication phase

□ During foetal development, certain cells in the germinal epithelium of the ovary are larger than others and also have larger nuclei.

□ These cells undergo mitotic divisions, producing undifferentiated germ cells called oogonia or egg mother cells in the ovary.

□ The oogonia have diploid, number of chromosome, 46 in humans.

□ The oogonia multiply by mitotic divisions and produce ovigerous cords or egg tubes of pfluger in mammals.

(b) **Growth phase :** It is prolonged and slow. Oogonia form rounded masses or egg nests at the tips of egg tubes of pfluger. OOGENESI MES NO OOGENESIS LIFE CYCLE GERMINAL EPITHELIAL IN FOETUS MULTIPLICAT 46 ION BIRTH OOGONI GROWTH $\frac{1}{46}$ PRIMARY OOCYTE (IN PROPHASE OF MEIOSIS - I BEFORE FIRST POLAR OVULATION Ο 23 BODY ECONDARY OOCYTE (MEIOSIS-II OVULATION ARRESTED AT SECONDARY MATURATI 23 OOCYTE ONMEIOSI (or RESTARTS MEIOSIS-II 23 SPER FERTILIZATI (() 23 23(0) () 23 SECONDARY 8 8 POLAR BODY OVUM WITH $\Gamma + E$

STAGES OF

STAGE OF

Fig. – Stages in

□ An egg nest forms ovarian follicle (Graffian follicle) one central oogonium grows and functions as primary oocyte. The others form the covering follicular cells. the latter provide

nourishment to primary oocyte. Some nourishment also comes from outside. Yolk is deposited in this state. This phenomenon is called vetellogenesis.

□ In cooperation with follicular cells, the enlarged primary oocyte secrete mucoprotein membrane or zona pellucida outside its own plasma membrane or vitelline membrane. There is increase in reserve food, size of nucleus, number of mitochondria; functioning of golgi apparatus and complexing of endoplasmic reticulam.

(c) Maturation phase

 \Box Meosis occurs. Nucleus shifts towards animal pole and undergoes meosis – I. A daughter nucleus alongwith small quantity of cytoplasm is extruded as primary polar body or polocyte below zona pellucida. Simultaneously primary oocyte is changed into haploid secondary oocyte. It proceeds with meosis – II but stops at metaphase-II. Ovum is generally shed in secondary oocyte stage.

□ After fertilization, the second meotic division is completed with unequal cytoplasmic cleavage. This forms a large cell the ootid with essentially whole of the cytoplasm, and a very small cell, the second polar body. The ootid and the second polar body are haploid as the second meotic division is equational. The first polar body may divide at about the same time into two polar bodies.

□ One primary oocyte forms, after two meiotic division, one haploid ootid and three haploid polar bodies. The ootid grows into a functional haploid ovum.

□ The polar bodies have no function and disintegrate due to lack of cytoplasm and food.

□ The formation of non functional polar bodies enables the egg to get rid of excess chromosomes. The unequal cytoplasmic division enables the ovum to retain the whole of cytoplasm of the primary oocyte in it for the development of the future embryo.

□ In humans, ova are released from the ovary in the secondary oocyte stage. Their maturation is completed in the mother's genital tract, usually after the sperm has entered for fertilization.

(iv) **Structure of ovum :** An ovum is generally spherical, nonmotile gamete with yolky cytoplasm and



enclosed in one or more egg envelops. Size of ovum varies in different animals and depends upon the amount of yolk. Size of ovum varies from 10μ to a few cm. Largest sized egg is of ostrich and is about $170 \times 135 \text{ mm}$. Egg size and yolk amount are interdependent. It is about 50μ in many polychaete worms, 150μ in tunicates but very large sized in birds and reptiles. In mammals, it is generally microlecithal and about 100μ .

Human ovum is microlecithal with large amount of cytoplasm. Cytoplasm is differentiated into outer, smaller and transparent exoplasm or egg cortex and inner, larger and opaque endoplasm or ooplasm.

Egg cortex is with some cytoskeletal structures like microtubules and microfilaments (Balinsky, 1981), pigment granules and cortical granules of mucopolysaccharides. Endoplasm is with cell-

organelles, informosomes tRNAs, histones, enzymes etc. Nucleus of ovum is large, bloated with nucleoplasm and is called germinal vesicle. Nucleus is excentric in position so human ovum has a polarity. The side of ovum with nucleus and polar body is called animal pole, while the opposite side is called vegetal pole.

Egg envelopes. Human ovum is surrounded by a number of egg envelopes :

- (a) Vitelline membrane : It is inner, thin, transparent and is secreted by ovum itself.
- (b) **Zona pellucida :** It is middle, thick, transparent and non-cellular.

(c) **Corona radiata :** It is outer, thicker coat formed of radially elongated follicular cells. Between the vitelline membrane and zona pellucida, there is a narrow perivitelline space.

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S.No.	Characters	Spermatogenesis	Oogenesis
1.	Site of	In the seminiferous tubules of	In the ovaries.
	occurrence	testes.	
2.	Total period	It is a continuous process and	It is a discontinuous process and
		completed in 74 days in humans	completed in a few days to years.
3.	Growth phase	Of shorter duration	Of longer duration
4.	Yolk synthesis	No yolk is synthesized in growth	Vitellogenesis occurs in growth
		phase	phase.
5.	Nuclear changes	Nucleus becomes condensed by	Nucleus is bloated due to increase
		the loss of superfluous materials.	in necleoplasm.
6.	Number of	One spermatogonium forms 4	One oogonium forms only one
	gametes	haploid sperms.	ovum.
7.	Polar bodies	Not formed.	Two or three polar bodies are
			formed.
8.	Site of	It is started and completed within	It is started inside the ovary but is
	completion	the testes.	generally completed outside the
			ovary.
9.	Size of gametes	Sperm is much smaller than	Ovum is much larger than
	formed	spermatogonium.	oogonium.

Differences between Spermatogenesis and Oogenesis

(vi) Types of eggs

(a) On the basis of amount and distribution of yolk

(1) Alecithal or Microleithal or Oligolecithal or Meolecithal and Isolecithal or Homolecithal :

The amount of yolk is very small in these types of eggs. (Oligolecithal or Microlecithal or Alecithal) and yolk is evenly distributed in these eggs (Isolecithal



or Homolecithal). Examples – Egg of Amphioxus, Eutheria (Human egg), Metatheria and Sea-urchin.

(2) **Mesolecithal or Telolecithal eggs :** In this type of egg the amount of yolk is moderate and yolk is concentrated in the basal part of egg (telolecithal egg). Examples – Egg of Amphibia, Petromyzon and Lung fishes.

(3) **Polylecithal or Macrolecithal or Megalecithal eggs :** Eggs are with large amount of yolk and this yolk is concentrated in the centre and cytoplasm is in the form of superficial layer around the yolk (centrolecithal eggs). Example – Insect's egg.

In discoidal or highly telolecithal eggs, the yolk is enormous in amount and cytoplasm is confined to a disc like area on yolk. This disc of cytoplasm is called germinal disc. Example – Eggs of reptiles, birds, protherian mammals.

YOLK

Note : Majority eggs are oval but the eggs of insects are long and cylindrical.

 \square Smallest eggs are of 50µ in the polychaeta and the largest eggs are of an ostrich.

(b) On the basis of fate

(1) **Determinate / Mosaic eggs :** Every part of fertilize egg has a definite fate, so that fate of every blastomere is determined from the beginning. It is found in invertebrates except echinoderms.

(2) **Indeterminate / Regulative eggs :** The fate of different parts of egg or its blastmeres is not predetermined. Example – Echinodermes, Vertebrates.

(c) On the basis of shell

(1) **Cleidoic eggs :** Eggs surrounded by a hard shell are know as cleidoic eggs. These eggs are found in those animals which have a terrestrial mode of life of which lay eggs on land. These eggs have more amount of yolk. These are adaptations to terrestrial mode of life. Shell prevents the egg from dessication. e.g. - Eggs of "Reptiles". "Birds". "Insects" and "Prototherians".

(2) Non - Cleidoic eggs : Eggs which are not surrounded by a hard shell are called Non-cleidoic eggs. These eggs are found in all oviperous animals which lay eggs in water and all viviperous animals. e.g. – All viviperous animals (Mammals) and all oviperous animals which lay eggs in water (Amphibians).

Structure of an oocyte : Oocyte is a large yolk containing cell. The nucleus is large and swollen and is termed as the "Germinal Vasicle". Oocyte is surrounded by membranes termed as the egg-membranes. Oocyte / Ovum alongwith the egg-membrane are termed as the egg. Egg = Ovum / Oocyte + Egg membrane.

Classification of egg – membranes : On the basis of origin, egg-membranes are of 3 types –

(1) **Primary egg membrane :** This membrane is secreted by the egg (ovum) itself. e.g. – Vitelline membrane, of human egg.

(2) **Secondary egg membrane :** This is found outside the primary egg membrane and is secreted by the ovary. *e.g.* Chorion of insect eggs, corona radiata and zona pellucida of human egg.

(3) **Tertiary egg membrane :** This present outside the primary and the secondary egg membrane. It is either secreted by the uterus or the oviduct. Egg jelly coat around frog's egg; albumen, shell membrane and shell of bird egg.
Functions of egg membranes

(1) To provide protection.

(3) To provide buoyancy to the amphinian eggs. (4) To provide nutrition (Birds, Reptiles)

(5) To help in excretion (Allantois)

Different types of eggs

(1) Insect egg: Eggs of insects are megalecithal or polylecithal in them yolk is present in the centre, so the eggs are also centrolecithal. Eggs of insects are cigar like. Along with plasma-membrane the egg has 2 egg-membranes.

(i) **Vitelline membrane :** This is a primary egg membrane and the egg itself secretes it around.

(ii) **Chorion**: This is a secondary egg membrane and is secreted by the ovary. In Insect's egg tertiary egg-membranes is absent. Chorion of insect's egg is ornamented *i.e.* there are specific markings on its egg membrane which are characters of Taxonomic importance. In the egg, a hole termed as micropyle is present which is the port of entry for sperms. Its cytoplasm is divided into 2 parts -

(b) Peripheral cytoplasm (a) Central

(a) **Central cytoplasm :** It is present in a very small amount in the centre of the egg. Egg nucleus is located in it.

(b) **Peripheral cytoplasm :** It is present in a very small amount along the periphery of the egg.

Yolk : In insect's egg yolk is present in a very large amount and this yolk is concentrated between the central and the Peripheral cytoplasm.

(2) Frog's egg: Eggs of frog are Teloecithal and Mesolecithal. The egg has 2 egg membranes.

(i) Vitelline membrane : This is a primary membrane, secreted around by the egg itself.

(ii) **Jelly – coat :** This is a tertiary egg-membrane. It is secreted by the oviduct. Secondary egg-membrane are absent in these egg's. Internally, the egg is divided into 2 areas –

(a) Animal pole (b) Vegetal pole

(a) Animal pole : This part has more amount of cytoplasm in it and

the egg nucleus is also located in it. In this part melanin granules are Fig. - Insect

found which prevent the egg from harmful radiations. Due to these melanin granules the frog's egg is

partly white and partly black. This helps in Camouflage. Sperm always enters inside the egg through the animal pole. The part from where the sperm enters inside the frog's egg in future forms the ventral part of the embryo. As the sperm enters inside the egg. The part directly opposite to the entry point becomes a clear-zone due to the rapid



Fig. - Frog's

(2) To check polyspermy.

MICROPYLE

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YOLK

VITELINE

MEMBRANE

CHORION

NUCLEUS

PERIPHERAL.

CYTOPLASM

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movement of melanin granules. this clear-zone is termed as the Grey-Crescent. This part with Grey-Crescent forms the dorsal part of the embryo in future.

(b) **Vegetal pole :** Here the yolk is concentrated in frog's egg, the part with cytoplasm in future forms the ectoderm. The Grey crescent part in future the Mesoderm and the part with yolk in future forms the endoderm.

Jelly-coats of all the eggs of a frog absorb water and swell up, to form a cluster of eggs termed as Spawn. Jelly-coat has air-bubbles, due to which the eggs don't drown. Jelly-coat is bilter in taste and so the eggs are protected from the enemies.

Important tips

- The longest phase of gametogenesis is growth-phase.
- Acrosome of the sperm is formed by the golgi-body.
- The Smallest sperm is of Crocodile (.02mm) and largest sperm is of discoglossus (2mm)
- Complete spermatogenesis in man takes place in 74 days.
- The second secon
- Therefore the second se
- Tondition in which sperms are totally absent in semen is also termed as Azospermia.
- The organisation of the synthesised in the growth phase.
- The Largest egg is of Ostrich which along with the shell is of 16 cms.
- ☞ Length of a human sperms in approx 55µ i.e.
- The condition of presence of normal number of motile sperms in human semen is termed as isozospermia.
- The condition of presence of completely non-motile sperms in human semen is termed as Necrospermia.
- The Smallest eggs are of humming bird.
- In lower animals large amount of eggs are poduced because their chances of survival are very less.
- The of egg-production. Mammals < Birds < Repitles < Amphibia < Pisces.
- [©] Cat and Rabbit are both induced ovulators.
- The life span of eggs in female reproductive organs is different e.g. in humans it is 48 hours.
- The Nucleus of the egg is termed as Germinal vesicle.
- The asexual process replaced by the sexual method is known as apomixis.
- Thallic organs in cockroach are related to male reproductive system.
- The No natural death in organisms showing binary fision e.g. Amoeba, so are called immortal.
- The croaking sound made by frog is sex call for female partner.
- Teuvenhock (1677) saw human sperm.
- The frog bidder canal help in sperm passout.

- Gynandromorph : An animal having male characteristics on one part and female characteristics on the other.
- *Gynaecomastia* : Enlarged functional mammary gland in male.
- **Azoospermia :** No sperms in semen.
- The **Oligospermia :** Sperms less than 20 million in per ml semen.
- **R.V. Graf (1672) :** Androgenesis discovered follicles in human ovary.
- Androgenesis : Development in which embryo has only paternal chromosomes, male parthenogenesis.
- Gynogenesis : Development in which embryo has only maternal chromosomes, female parthenogenesis.
- *Gland of Tyson :* Modified sebaceous glands present around corona of glans.
- In many birds (exception some birds of prey) only the left ovary and left oviduct are function. The right ones are non-functionsl.
- **Seminiferous tubules :** Structural and functional unit of testes.
- **Hysterectomy :** Surigcal removal of uterus.
- Castration / Chidectomy : Removal of testes. It produce eunuchs. Castration changes aggressiveness of male into docile nature.
- Corpus luteum : Persists for two weeks in case of non pregnancy and four months when pregnancy has taken place.
- **Prostatitis :** Inflammation of prostate gland. Prostate cancer is common in ageing males.
- **Human egg :** 0.1 mm in diameter.
- **Prostatectomy :** Surgical removal of prostate gland.
- Peculiar spermatozoa : Ascaris has amoeboid spermatozoa devoid of flagellum. Some crustaceans also have atypical sperms.
- The Sperms form about 10% of the ejaculated semen.
- * Protandry : Spermatozoa mature earlier than ova in bisexual animals e.g. Hydra, Earthworm.
- The Andrology : Branch of medicine concerned with diseases peculiar to male sex.
- **Spermatorrhoea :** An involuntary discharge of semen, without orgasm.
- *The Spermatophore :* A capsule containing spermatozoa, as in cuttle fish and salamander.
- The Menarche : Beginning of menstrual cycle and other bodily changes.
- **Oophoritis :** Inflammation of an ovary.
- Vitellogenesis : Process of laying down of yolk in the primary oocyte. It occurs in the prophase of meosis-I.
- Metagenesis : Alternation of sexually and asexually reproducing forms in the life cycle of an animal e.g. Obelia.
- The **Protogyny :** Ova mature earlier than sperm in abisexual animal e.g. Herdmania.
- * Spermathecae : Small sacs that form a part of female reproductive system of earthworm and store

spermatozoa received from the male for use in future.

- The **Oviparous :** Animals that lay eggs e.g. Birds.
- * Viviparous : Animals which give birth to young ones, e.g. most mammals.
- **Ovoviviparous :** Animals that produce eggs which hatch within their bodies.
- **Ovipositor :** A specialised female organ for laying eggs, specially in insects.
- **Rutting season :** It is a brief period of pronounced sexual activity in males.
- Tubectomy (Salpingectomy) : Surgical removal of oviducts.
- **Von bear :** Discovered ovum.
- Strobilation : Asexual multiplication by transverse fusion and is found in Scyphistoma of Aurelia and also found in Taenia.
- The Richard owen gave term parthinogenesis.
- Testes are also called spermaries.
- **Vaginal coelom :** Cavity of scrotal sac.
- They dig cells are absent from the testes of frog and are characteristics of mammalian testes.
- To-gene : Testicular organisation gene located on Y-chromosome and is a male determining factor.
- Adiposogenital syndrome : Hypogonadism in male and characterised by obesity and child like sexual organs.
- So man no woman syndrome : Characterised by male-female pseudohermaphroditism in which external sexual characters are opposite to genetic and gonadal sex.
- The Wolffian duct : Acts as male genital duct, while mullarian duct is vestigeal.
- **Mesosalpinx :** Mesentry suspending the fallopian tube.
- **Mesometrium :** Mesentry suspending the uterus.
- **Uterus :** It is also called womb.
- There is formed of most powerful smooth muscles.
- Testibule : Acts as a urinogenital sinus.
- **Perineum :** Area between the fourchette and anus.
- The Bartholin's or Bulvo vestibular glands of female homolegous to Cowper's glands of male.
- **Precocious puberty :** Puberty attained before the normal age.
- **Hypermastia :** More than normal number of breasts.
- The Number of breasts in female depends upon the number of young ones born at a time.
- Female ascaris has paired ovaries so is called didelphic.
- The seasonally breedings animals, testes show testicular cycle.
- The Spermatogenesis is continous process, while oogenesis is a discontinuous process.
- In spermatogenesis, spermatogonium produces four sperms while in oogenesis, one oogonium produces one ovum and 2 or 3 polar bodies.
- **Golgi rest :** Part of golgi body which is lost during spermiogenesis.

- **Gynosperm :** Sperm with 22 A+X chromosome.
- **Androsperm :** Sperm with 22 A+Y chromosome.
- Yolk nucleus : Also called Balbiani body. A mass of mitochondria and golgibody near the nucleus which controls vitellogenesis.
- **Redundancy :** Gene amplification of r-RNA genes for rapid RNA and protein synthesis.
- Ring centriole : Also called annulus or Jensen's ring. Menstruation is also called "Weeping of uterus for the lost ovum or funeral of unfertilized egg".
- The Menstrual cycle is associated with withdrawal or progesterone.

ASSIGNMENT

REPRODUCTIVE AND ITS TYPE

Basic Level

In all the methods of asexual reproduction

1.

	(a) Offsprings produced are genetically identical to the parents				
	(b) Offsprings produce	ed are genetically different	from the parents		
	(c) Offsprings produce	(c) Offsprings produced may or may not be identical to the parents			
	(d) None of these				
2.	In sexual reproduction	, offsprings resemble the p	parents		
	(a) Structurally but no	t functionally	(b) Functionally but no	t structurally	
	(c) Both structurally as	nd functionally	(d) Neither structurally	nor functionally	
3.	Which is mode of repr	oduction in Amoeba			
	(a) Binary fission only	7	(b) Binary fission and a	multiple fission	
	(c) Binary fission and	conjugation	(d) Multiple fission onl	y	
4.	Which type of reprodu	ction is found in Hydra			
	(a) Polyembryony	(b) Sexual and asexual	(c) Parthenogenesis	(d) Encystment	
5.	Differentiation in mor	phology of the two sexes of	of the same species is cal	led	
	(a) Hermaphrodite	(b) Heteromorphosis	(c) Sexual dimorphism	(d) Unisexual	
6.	Asexual reproduction	takes place in			
	(a) Higher animals	(b) Lower animals	(c) Plants	(d) All the above	
7•	As a result of binary fi	ission of number of individ	luals produced by one fis	ssion is	
	(a) Two	(b) Three	(c) Four	(d) Five	
8.	Common method of as	sexual reproduction is by			
	(a) Regeneration	(b) Budding	(c) Archeocytes	(d) Gemmulation	
9.	A phenomenon is term	ned parthenogenesis when			
	(a) Artificial fertilizati	on occurs	(b) Egg is fertilized by a sperm		
	(c) Egg undergoes clea	avage without fertilization	(d) Sperm dies before f	ertilization	
10.	Natural parthenogenes	sis occurs in			
	(a) Frog to form femal	les	(b) Honeybee to produce	ce drones	
	(c) Cockroach		(d) Vegetarian eggs		

11.	Animals which show	vivipary include			
	(a) Whales	(b) Turtles	(c) Bony fishes	(d) Running birds	
12.	Which one is an ovipa	arous animal			
	(a) Penguin	(b) Amoeba	(c) Whale	(d) Bat	
13.	Asexual reproductive	body is called			
	(a) Egg	(b) Sperm	(c) Ovum	(d) Blastos	
14.	Development of egg v	without fertilization is call	led		
	(a) Parthenogenesis	(b) Gametogenesis	(c) Metagenesis	(d) Oogenesis	
15.	During binary fission	the cell division is			
	(a) Mitosis	(b) Meiosis	(c) Amitosis	(d) Cytokinesis	
16.	Natural parthenogene	sis occurs in			
	(a) Protozoans	(b) Earthworm	(c) All insects	(d) Honeybee	
17.	In honeybees, the drones are produced from				
	(a) Unfertilized eggs		(b) Fertilized eggs	(b) Fertilized eggs	
	(c) Larvae fed with ro	yal jelly	(d) Fasting larvae		
18.	Viviparity is not foun	d in			
	(a) Prototheria	(b) Bat	(c) Mouse	(d) Man	
19.	Viviparity is found in				
	(a) Earthworm	(b) Rabbit	(c) Pigeon	(d) Frog	
20.	Asexual reproduction	involves			
	(a) Two parents	(b) One parent			
	(c) One ovum	(d) One sperm and ovu	m		
Adv	ance Level				
21.	The asexual process r	eplaced by the sexual met	hod is known as		
	(a) Semigamy	(b) Amphimixis	(c) Apospory	(d) Apomixis	
22.	Phallic organs in cock	croach are related to			
	(a) Male excretory sy	stem	(b)Male reproductiv	(b)Male reproductive system	
	(c) Female excretory	system	(d) Female reproduc	(d) Female reproductive system	
23.	Gemmule formation i	n sponges is helpful in	(a) I entare reproduce		
-0.	(a) Parthenogenesis	(b) Sexual reproduction	1		
	(c) Only disseminatio	(c) Only dissemination (d) Asexual reproduction			
24	Drones in a colony of	honey bees originate by			
	(a) Thelotoky	liency cool originate by	(b) Arrhenotoky		
	(c) Cyclic parthenoge	nesis	(d) Diploid parthene	ogenesis	
	() = J === r === 580	-	() r rr	0	

25.	. Which of the following shows the sexual dimorphism				
	(a) Hydra and Ascaris		(b) Hydra and Oryctol	agus	
	(c)Ascaris and Phereti	та	(d) Ascaris and Orycto	olagus	
26.	The croaking sounds n	nade by frogs is			
	(a) Hunger call		(b) Just a musical note		
	(c) Signaling call of da	anger	(d) Sex call for female	partner	
27.	Development of sexua	l reproductive organs in la	rval condition is known	as	
	(a) Autogamy	(b) Isogamy	(c) Anisogamy	(d) Pedogenesis	
28. The disadvantage of parthenogenesis is					
	(a) Establishment of polyploid generation				
	(b) Elimination of variety in population				
	(c) Means of reproduct	tion			
	(d) Does not encourage	e the appearance of new a	nd advantageous combin	nations of genes	
29. Some species parthenogenesis may alternate with sexual reproduction this production			is process is called		
	(a) Complete partheno	genesis	(b) Incomplete or cyclic parthenogenesis		
	(c) Both the above		(d) None of these		
30.	o. Fusion of two dissimilar gametes is known as				
	(a) Allogamy	(b) Anisogamy	(c) Autogamy	(d) Dichogamy	
31.	Natural parthenogenes	is occurs in			
	(a) Frog to form femal	e	(b) Honeybee to produce drones		
	(c) Cockroach		(d) Vegetarian eggs		
32.	Cell division in sexual	reproduction is			
	(a) Amitotic	(b) Mitotic			
	(c) Meiotic	(d) Both meiotic and mit	otic		
33.	Which type of reprodu	ction of Hydra is most co	mmon		
	(a) Budding	(b) Cracking			
	(c) Sexual reproduction	n (d)Gemetogenesis form	L		
34.	Isogametes are				
	(a) Morphologically al	ike	(b) Functionally alike		
	(c) Steriale		(d) Those which devel	op parthenogenetically	
35.	Binary fission is a form	n of			
00.	(a) Asexual reproducti	on (b)Division of amoel	na		
	(c)Fusion of chromoso	mes (d)Breaking of nucle			
	(c)rusion of chiomosomes (u)breaking of nucleus				

MALE REPRODUCTIVE SYSTEM

Basi	c Level			
36.	Majority of mammalian	n spermatozoa acquire cap	pacitation in	
	(a) Female reproductiv	e tract	(b) Female reproductiv	e tract/Epididymis
	(c) Epididymis		(d) Seminal vesicle	
37.	In rabbit, ex-abdomina	l reproductive organs are		
	(a) Testes, Penis, Epidi	dymis	(b) Testes, Vas deferen	s, Testes sac
	(c) Testes, Vas deferen	s, Ejaculatin duct	(d) Testes sac, Seminal	Vesicle, Epididymis
38.	Which of the following	g is the endocrine tissue of	testes	
	(a) Epidermis	(b) Inguinal canal	(c) Leydig cells	(d) Spermatic cord
39.	Which one is not found	l in testis of frog		
	(a) Sertoli cell	(b) Seminiferous tubule	(c) Germinal cell	(d) Interstitial cell
40.	Cowper's glands secret	e a substance to		
	(a) Neutralize acidity of urethra		(b) Nourish sperms	
	(c) Kill pathogens		(d) All the above	
41.	Composition of semen is			
	(a) Secretion of the testes and epididymis		(b) Secretions of the se	minal vesicles
	(c) Secretions of prosta	te gland and bulbourethra	l glands	(d) All the above
42.	The fold of skin coveri	ng the penis is called		
	(a) Corpora covernosa	(b) Corpus spongiosum	(c) Prepuce	(d) None of these
43 .	Location and secretion	of Leydig's cell are		
	(a) Liver cholesterol	(b) Ovary estrogen	(c) Testis testosterone	(d) Pancreas glucagon
44.	Seminiferous tubules d	evelop central lumen after	î	
	(a) Birth	(b) Prepuberal time	(c) Puberty	(d) Old age
45 ∙	"Sertoli cells" in huma	n testis are found in		
	(a) Seminiferous tubule	es	(b) Leydig cells	
	(c) Outside the seminif	erous tubules	(d) None of these	
46.	The correct order of the	e reproductive tract of a m	ale human being is	
	(a) Rete testis, epididy	mis, vasa efferentia, urethi	ra	
	(b)Rete testis, vasa effe	erentia, epididymis, urethr	a	
	(c) Vasa efferentia, epi	didymis, urethra, rete testi	S	
	(d) Urethra, rete testis,	epididymis, vasa efferenti	a	

47 •	Inguinal canal is the co	onnection between the scre	otal sac and the	
	(a) Tunica vaginalis	(b) Urethral lumen	(c) Abdominal cavity	(d) Urethra masculinus
48.	Cowper's glands are pr	resent in		
	(a) Female mammals	(b) Male mammals	(c) Both (a) and (b)	(d) None of these
49.	Bulbourethral gland is	also known as		
	(a) Prostate gland	(b) Cowper's gland	(c) Perineal gland	(d) Meibomian gland
50.	Which of the following	g is an accessory reproduc	tive gland in male mam	nals
	(a) Prostate gland		(b) Gastric gland	
	(c) Mushropm shaped	gland	(d) Inguinal gland	
51.	In man the epididymis	from anterior to the poste	erior is divided into	
	(a) Caput, corpus and cauda		(b) Corpus, vas deferen	ns and caput
	(c) Corpus, cauda and	caudal region	(d) Caput, cauda and v	as deferens
52.	There are some specia These are	al types of cells found in	the seminiferous tubul	es known as sertoli cells.
	(a) Germinal cells	(b) Reproductive cells	(c) Somatic cells	(d) Protective cells
53 .	Testis produce			
	(a) Sperms	(b) Eggs	(c) Seeds	(d) Spores
54 .	The seminiferous tubu	les of the testis are lined b	by the germinal epithelium	m consisting of
	(a) Cells of sertoli	(b) Spermatocytes	(c) Spermatogonium	(d) Spermatids
55.	Testes in rabbit are			
	(a) Inside the body		(b) On the sides of the	kidneys
	(c) In scrotal sacs		(d) On either side of dorsal aorta	
56.	Supporting cells found	in between the germinal	epithelium of testes are o	called
	(a) Interstitial cells of I	Leydig	(b) Sertoli cells	
	(c) Granular cells		(d) Phagocytes	
5 7•	Cells of leydig are four	nd in		
	(a) Kidney of rabbit	(b) Kidney of frog	(c) Testis of frog	(d) Testis of rabbit
58.	Which of the following	g cells are present in mam	malian testes and help to	o nourish sperms
	(a) Leydig cells	(b) Oxyntic cells	(c) Interstitial cells	(d) Sertolic cells
59 .	Each epididymis consi	sts of a single tightly coile	ed tube whose length is a	ibout
	(a) 20 <i>cm</i>	(b) 20 <i>feet</i>	(c) 20 <i>metres</i>	(d) None of these

60.	The acrosome plays im	portant role in		
	(a) Motility of sperm		(b) Penetration of ovum	n by sperm
	(c) The fusion of pronu	clei of the gametes	(d) None of these	
61.	The acrosome of the sp	perm is derived from		
	(a) Mitochondria	(b) Nucleus	(c) Golgi bodies	(d) Centrosome
62.	Release of spermatozoa	a from urethra by male and	imals is called	
	(a) Spermatogenesis	(b) Spermiogenesis	(c) Ejaculation	(d) Insemination
63.	In the male rabbit, the	testes are located in		
	(a) Thoracic cavity		(b) Abdominal cavity	
	(c) Pericardial cavity		(d) Extra abdominal scr	rotal cavity
64.	In rabbit the sperms are	e stored and nourished in		
	(a) Testes	(b) Vasa efferentia	(c) Epididymis	(d) Spermatic cord
65.	Bidder canals help to p	ass out		
	(a) Ova	(b) Sperms	(c) Bile	(d) Saliva
66.	The structure of testis of	of a mammal can be identi	fied by the presence of	
	(a) Spermatogonia	(b) Spermatocytes	(c) Cells of Sertoli	(d) Interstitial cells
67.	In the testis of rabbit, the	he hormone secreting cells	s are	
	(a) Spermatogonia	(b) Spermatocytes	(c) Sustentacular cells	(d) Cells of Leydig
68.	Which one is primary s	sex organ		
	(a) Scrotum	(b) Penis	(c) Testis	(d) Prostate
69.	Secondary sex organ is	6		
	(a) Testis	(b) Breast	(c) Beard	(d) Vas deferens
70.	Scrotal sacs of man and	d rabbit are connected with	h the abdominal cavity b	у
	(a) Inguinal canal	(b) Haversian canal	(c) Vagina cavity	(d) Spermatic canal
71.	Temperature in scrotur	n necessary for sperm form	nation should be	
	(a) 2° C above body ten	nperature	(b) 2°C below body temperature	
	(c) 4°C above body ten	nperature	(d) 4°C below body temperature	
72.	In man the two vasa de	ferentia open into		
	(a) Urinary bladder	(b) Rectum	(c) Urethra	(d) Penis
73.	Survival time of sperm	s introduced into the vagin	na may be	
	(a) $1 - 2$ days	(b) 3 – 4 days	(c) 5 – 10 days	(d) 1 weak
l I				

1					
74.	Cowper's gland is pres	ent in			
	(a) Cockroach	(b) Rabbit	(c) Earthworm	(d) Frog	
75.	The capsule enclosing	testis of mammal is called	1 as		
	(a) Tunica albuginea	(b) Tunica membrana	(c) Tunica vaginalis	(d) Tunica vesculosa	
76.	Seminiferous tubules a	re found in			
	(a) Testis	(b) Ovary	(c) Kidney	(d) Lung	
77•	Which is secreted by a	acrosome			
	(a) Hyaluronic acid	(b) Hyaluronidase	(c) TSH	(d) Fertilizin	
7 8.	Sertoli cells are found	in			
	(a) Kidney of rabbit	(b) Ovary of frog	(c) Testes of rabbit	(d) Ovary of rabbit	
7 9 .	Which cells in the testi	is secrete testosterone			
	(a) Interstitial cells or cells of Leydig		(b) Cells of the germinal epithelium		
(c) Sertoli cells (d) Secondary spermatocyte		ocytes			
80.	From the seminiferous	tubules the spermatozoa	pass into		
	(a) Epididymis	(b) Vas deferens	(c) Seminal vesicle	(d) Rete testis	
81.	Germinal epithelium is	5			
	(a) Sensory	(b) Columnar	(c) Cuboidal	(d) Squamous	
82.	Male hormone is				
	(a) Corpus luteum	(b) Testosterone	(c) Progesterone	(d) Gonadotropin	
83.	In males, the essential	hormones for secondary s	sexual characteristics are		
	(a) Progesterone	(b) Testosterone	(c) Relaxin	(d) Estrogen	
84.	Which gland in mamm	als secretes alkaline juice	for lubrication		
	(a) Pineal body	(b) Prostate gland	(c) Cowper's gland	(d) Testis	
85.	The sperms become me	otile in human being in			
	(a) Seminiferous tubul	es (b)Vas deferens			
	(c) Epididymis	(d)Only in seminal v	vesicle		

Advance Level

86. In most of the mammals the testes are situate outside the abdominal cavity because

- (a) Sperms produced in scrotal sac are more in number
- (b) Sperms produced in abdominal cavity are provided with less motility

(c) Sperms produced in scrotal sac require lesser temperature for their best fertilization capacity

(d) Sperms produced in scrotal sac are bigger

87.	7. The nutritive medium for the ejaculated sperms is given by the				
	(a) Seminal fluid	(b) Vaginal fluid	(c) Uterine lining	(d) Fallopian tube	
88.	Cryptorchidism is the c	condition in man when			
	(a) There are two testis	in each scrotum	(b) Testis do not descer	nt into the scrotum	
	(c) Testis enlarge in the	e scrotum	(d) Testis degenerate in	the scrotum	
89.	The seminal vesicle or	uterus masculinus in rabb	it is found at the junctior	n of	
	(a) Prostate and Cowpe	er's glands	(b) Prostate and vasa de	eferens	
	(c) Prostate and urethra	l	(d) Vasa deferens and t	estes	
90.	By the contraction of s	permatic cord the testis of	f man are not taken in to	the abdominal cavity. It	
	is due to the following	structure			
	(a) Narrowness of ingu	inal canal			
	(b) Attachment of testis	s by gubernaculum testis to	o the scrotal sac only		
	(c) (a) and (b) both (d) Each a diagram draw has been derived as $d = 1$				
	(d) Fat bodies and gube	ernaculum present over the	e testis		
91.	(c) Menurele en highly englished enimele			era because	
(a) Mammals are highly evolved animals (b) Sperms require a lower temperature				wer temperature	
	(c) Of the presence of I	ong vas deferens	(d) Of the presence of t		
92.	There is a connective the	ssue cord extending betwe	een the testis and abdom	inal wall called	
	(a) Testis cord	(b) Gubernaculum	(c) Mesentric cord (d) Spermatic cord		
93.	The elastic tissue conne	ecting the cauda epididym	is to the scrotal sac is		
	(a) Gubernaculum	(b) Tendinous cord	(c) Scrotal ligament	(d) Caput epididymis	
94.	A person which shows	the secondary sexual char	racters of both male and	female is called	
	(a) Intersex	(b) Hermaphrodite	(c) Bisexual	(d) Gynandromorph	
95.	Failure of descending t	estis into scrotum is know	n as		
	(a) Impotency	(b) Cryptorchidism	(c) Castration	(d) paedogenesis	
96.	Gubernaculum cordis i	s a contractile structure the	at		
	(a) Pulls down the testi	s during breeding season i	nto the scrotal sac		
	(b) Allows daily migrat	tion of the testis from the a	abdominal cavity into the	e scrotum	
	(c) Facilitates ejaculation	on of spermatozoa from th	e testis		
	(d) Keeps the testis in p	position			
9 7•	Functions of seminal fl	uid is/are			
	(a) Maintains the viabil	lity of sperms	(b) Maintains motility of	of sperms	
	(c) Provides proper pH	and ionic strength	(d) All the above		

98. Bidder's canal is found in

(a) Testes of frog (b) Kidney of frog (c) Ovary of mammal (d) Kidney of mammal

99. In which animal the testes are abdominal during embryonic stages but migrate to scrotum just before birth where they remain throughout life

(a) Elephants (b) Men (c) Rats (d) Whales

100. The narrow middle part of the epididymis is called

(a) Caput epididymis (b) Cauda epididymis (c) Corpus epididymis (d) All the above

101. Which of the following statements is incorrect. Human spermatozoa normally

(a) At a concentration of 1 million/ml of ejaculate will fertilize the ovum

(b) Are released in large numbers after a few days abstinence

(c) Contain enzyme in their head which helps in penetration of ovum

(d) Move with the help of their tails

102. The testes of a great majority of mammals are typically enclosed in an extra abdominal sac, the scrotum. The temperature inside the scrotum is lower than that in the abdomen. What will happen if the temperature of the scrotum is artificially maintained to the level of abdominal temperature

(a) The germinal epithelium will produce a large quantity of androgen secretion

(b) The germinal epithelium of the testes will divided faster, thus producing more sperms

(c) The germinal epithelium of the testes will degenerate, resulting in sterility

(d) The germinal epithelium will carry out normal spermatogenesis

103. The scrotal sac of a male mammal is homologous to

	(a) Clitoris	(b) Labia majora	(c) Vagina	(d) Uterus	
104.	Testicular degeneration deficiency of	and other disorders of	of reproductive system	m in mammals are due	to the
	(a) Vitamin A	(b) Vitamin B	(c) Vitamin K	(d) Vitamin E	
105.	If Cowper's glands are r	emoved. They will affe	ect		

(a) Erection of penis(b) Sperms(c) Sex recognition(d) Sexual behaviour106. Ducts leading from the testes of rabbit are called

(a) Genital ducts (b) Spermatic ducts (c) Urinary ducts (d) Vasa efferentia

107. In rabbit, heat of the epididymis present at the head of the testis is called(a) Vas deference(b) Cauda epididymis(c) Gubernaculum(d) Caput epididymis

108. If the vas deferens of a man is surgically disconnected

- (a) Sperms in the semen will be without nuclei (b) Semen will be without sperms
- (c) Spermatogenesis will not occur (d) Sperms in the semen will be non motile

10	09.	a. Azoospermia means				
		(a) A gynaecological p	roblem	(b) Childlessness		
		(c) Cessation of menstr	ruation	(d) No sperm in semer	1	
11	10.	In cryptorchidism				
		(a) Spermatogenesis fa	ils to occur	(b) Maturation of sper	ms doesn't occur	
		(c) Testis descend ingu	inal canals	(d) None above		
11	11.	Erectile penis tissue is	called			
		(a) Corpora cavernosa				
		(b) Paired corpora cavernosa and unpaired corpus spongiosum				
		(c) Corpus spongiosum				
		(d) All above				
11	12.	Prostate gland produce	es a secretion for			
		(a) Attracting sperms		(b) Stimulating sperm	activity	
		(c) Inhibiting sperm ac	tivity	(d) None of these		
11	13.	Prostate gland is presen	nt			
		(a) On ureter	(b) On kidney	(c) On testis	(d) Around urethra	
11	14.	The function of vas def	terens is to			
		(a) Store the sperms	(b) Conduct the sperms	(c) Mature the sperms	(d) None of these	
11	15.	The duct which carries	sperms from testis and ep	oldidymis to the penis is		
		(a) Vasa efferentia tubules	(b) Vasa differentia	(c) Ureter	(d) Seminiferous	
11	16.	Which of the following	g sugar in semen is a sourc	ce of energy for the sper	matozoa	
		(a) Sucrose	(b) Glucose	(c) Fructose	(d) Galactose	
11	17.	Corpus spongiosum is	part of			
		(a) Ovary	(b) Testis	(c) Uterus	(d)Male copulatory organ	
11	18.	In man sperms move a	fter ejaculation at a rate of	f nearly		
		(a) 2 to 4 <i>mm/minute</i>	(b) 2 to 4 <i>feet /minute</i>	(c) 2 to 4 inches /minu	the (d) $2 \text{ to } 4 \text{ cm/minute}$	
11	19.	The sperms achieve me	otility and maturity in			
		(a) Prostate gland	(b) Epididymis	(c) Seminal vesicle	(d) Cowper's gland	
12	20.	In rabbit, testes remain	s outside body cavity in so	crotal sacs because		
		(a) Spermatogenesis re	equires a lower temperatur	the than that of the body		
		(b) Testes can obstruct	the urine flow			
		(c) Hormone formation	n requires a lower body ter	mperature		
		(d) It helps in coitus				
1						

121.	Vasa efferentia connec	t the		
	(a) Testis with epididy	mis	(b)Kidneys with clo	oaca
	(c) Testes with urinoge	nital ducts	(d)None of these	
122.	Common duct formed	by union of vas deferens a	nd duct from seminal ve	sicle is
	(a) Urethra	(b) Tunica vasculosa	(c) Ejaculatory duct	(d) Spermatic duct
123.	pH of human semen is			
	(a) 4.5 – 5.5	(b) 6.5 – 6.8	(c) 7 . 35 – 7 . 5	(d) 8.2 – 8.5
124.	When accessory genita	l gland occurs only in mal	e mammal	
	(a) Cowper's gland	(b) Bartholin gland	(c) Prostate gland	(d) Perineal gland
125.	In human male a single	e ejaculation may contain .	million spermate	zoa
	(a) 500	(b) 200	(c) 300	(d) 100
126.	The testes are abdomin	al in		
	(a) Elephant	(b) Goat	(c) Kangaroo	(d) Rabbit
127.	Seminal fluid contains			
	(a) Fructose	(b) Citrate	(c) Ascorbic acid	(d) All of these
128.	Sperms are temporarily	v stored in		
	(a) Prostate	(b) Epididymis	(c) Seminal vesicle	(d) All of these
129.	Sugar fructose is presen	nt in the secretion of		
	(a) Bartholin's gland	(b) Seminal vesicle	(c) Perineal glands	(d) Prostate gland

FEMALE REPRODUCTIVE SYSTEM

Basic Level

13	30.	. Rupturing of follicles and discharge of ova is known as				
		(a) Copulation	(b) Conjugation	(c) Ovulation	(d) Oviposition	
13	31.	In mammals the female	e secondary sexual charact	ers are developed by the	hormone	
		(a) Relaxin	(b) Estrogens	(c) Progesterone	(d) Gonadotropins	
13	32.	Mullerian duct is				
		(a) Oviduct	(b) Sperm duct	(c) Ureter of man	(d) Urethra	
13	33.	The structure formed at	fter release of ova from gra	aafian follicles and secre	tory in nature, is	
		(a) Corpus callosum	(b) Corpus luteum	(c) Corpus albicans	(d) Corpus stratum	
13	34 .	An atretic follicle is				
		(a) Also known as corpus albicans				
		(b) That follicle which fails to mature and degenerates				
		(c) That follicle which	has released the ovum	(d) None of these		
1						

135.	5. Puberty occurs in females at the age of				
	(a) 8 – 10 years	(b) 11 – 14 years	(c) 15 – 17 years	(d) 18 – 20 years	
136.	In the 28 day human ov	varian cycle, the ovulation	takes place typically on		
	(a) Day 1 of the cycle	(b) Day 5 of the cycle	(c) Day 14 of the cycle	(d) Day 28 of the cycle	
137.	The cyclic period of se	xual activity in non – hum	nan female mammals is c	alled	
	(a) Menstruation	(b) Luteinization	(c) Oogenesis	(d) Estrous	
138.	The substance secreted	by the corpus luteum is			
	(a) Hormone	(b) Enzyme	(c) Pheromone	(d) Bile	
139.	The menstrual cycle in	normal adult woman is of	ĺ		
	(a) 48 days	(b) 38 days	(c) 18 days	(d) 28 days	
140.	Parturition duct in fema	ale is called			
	(a) Uterus	(b) Oviduct	(c) Vagina	(d) Cervix	
141.	Corpus luteum in mam	mals is present in			
	(a) Heart and initiates atrial contraction				
	(b) Brain and connects	the two cerebral hemisphe	eres		
	(c) Ovaries and produc	es progesterone	(d) Skin and acts as a p	ain receptor	
142.	The menstrual cycle be	gins with the casting off o	of		
	(a) Placents		(b) Blood		
	(c) Endometrial lining	alongwith blood vessels	(d) All the three		
143.	In rabbit, the uterus is				
	(a) Bicornute	(b) Multicornute	(c) Unicornute	(d) Acornute	
144.	In human beings the me	edian tube where the uteru	us opens independently is called		
	(a) Cervix	(b) Clitoris	(c) Vagina	(d) Cloaca	
145.	In woman cessation of	menstruation occurs at th	e age of		
	(a) 12 –1 4 years	(b) 45 – 58 years	(c) 60 years	(d) Does not occur at all	
146.	In human females at t	he time of birth there are	e two million ova: how	many of them normally	
	reach maturity in the co	ourse of normal reproducti	ve life		
	(a) 500	(b) 1,000	(c) 2,000	(d) 5,000	
147.	Human female is				
	(a) Seasonal ovulator		(b) Spontaneous ovulat	or	
	(c) Occasional ovulato	r	(d) Periodical ovulator		

14	48.	Before the formation of	f corpous luteum the body	formed is	
		(a) Corpous albicans		(b) Corpous media	
		(c) Corpous haemorrha	igicum	(d) None of these	
14	49 .	Graafian follicle charac	cteristically found in the		
		(a) Thyroid of mamma	l (b) Ovary of frog	(c) Testis of mammal	(d) Ovary of mammal
15	50.	Clitoris in female is			
		(a) Homologous to pen	is	(b) Analogous to penis	
		(c) Functional penis in	female	(d) Non-functional pen	is in male
15	51.	The mammalian follicl	e was first described by		
		(a) Von Baer	(b) De Graaf	(c) Robert Brown	(d) Spallanzil
15	52.	Corpus luteum is the so	ource of secretion of		
		(a) Estrogen	(b) Progesterone	(c) Estradiole	(d) LH
15	53.	Bartholin's glands in ra	bbit are found in		
		(a) Male and produce a	a viscous alkaline fluid wh	ich neutralizes acidity ir	the urethra
		(b) Male and produce t	he clear liquid part of the	spermatic fluid	
		(c) Female and produce the hormone estrogen which regulates secondary sexual characters			
	(d) Female and produce a clear fluid which lubricates the vestibule during copulation				g copulation
15	54.	The structure which att	aches the ovaries with the	e dorsal wall is known as	
		(a) Wolffian body	(b) Mesovarium	(c) Mesorchium	(d) Fimbricated body
15	55.	Ovulation in mammals	is caused by		
		(a) FSH and TSH	(b) FSH and LH	(c) FSH and LTH	(d) LTH and LH
15	56.	A secondary character	is		
		(a) Breast	(b) Ovary	(c) Testis	(d) Thyroid
15	57.	Atretic follicles are fou	ind in the		
		(a) Liver	(b) Testis	(c) Thymus	(d) Ovary
15	58.	In case of nonfertilizati	ion, corpus luteum		
		(a) Stops secreting prog	gesterone	(b) Changes to corpus albicans	
		(c) Starts producing pro	ogesterone	(d) None of the above	
15	59.	The changes that occur	rs in female at the onset of	puberty are	
		(a) The enlargement of	breasts	(b) Beginning of mense	rual cycle
		(c) Stoppage of growth	of long bone and height	(d) All the above	
16	60.	The follicle that rupture	es at the time of ovulation	promptly fills with bloo	d, forming
		(a) Corpus haemorrhag	gicum	(b) Corpus luteum	
		(c) Corpus albicans		(d) Corpus callosum	

161.	Oestrous is a			
	(a) Heat period	(b) Passive period	(c) Active period	(d) None of these
162.	First menstrual cycle is			
	(a) Parturition	(b) Menopause	(c) Menarche	(d) Implantation
163.	When is progesterone s	ecreted		
	(a) After ovulation		(b) Before ovulation	
	(c) At the time of partu	rition	(d) After parturition	
164.	Oestrous cycle is chara	cteristic of		
	(a) Mammals		(b) Mammalian female	28
	(c) Human female		(d) Mammalian female	es other than primates
165.	Female rabbit is			
	(a) Monoestrus	(b) Diestrus	(c) Polyestrus	(d) None of these
166.	Voice is high pitched in	1		
	(a) Aged persons	(b) Adult males	(c) Boys	(d) Females
167.	Fallopian tube is the pa	rt of		
	(a) Uterus	(b) Ureter	(c) Oviduct	(d) Vas deferens
168.	When pregnancy does i	not occur, the life of corpu	is luteum is about	
	(a) 10 days	(b) 14 days		
	(c) 28 days	(d) Corpus luteum is not	found	
169.	In the ovum of rabbit, g	graafian follicle is		
	(a) Oogonial cells	(b)Corpus luteum		
	(c) Corpus albicans	(d)Theca externa, the	eca interna, oocyte and fe	ollicle cells
170.	Which part of the ovary	y in mammals acts as an e	ndocrine gland after ove	ilation
	(a) Vitelline membrane	(b) Graafian follicles	(c) Stroma	(d) Germinal epithelium
171.	Stroma is a term applie	d to		
	(a) Gall stone			
	(b) Ovarian follicles			
	(c) Connective tissue in	which graafian follicles	are embedded	
	(d) Connective tissue si	urrounding the seminifero	us tubules	
	What is the formula and	utrounding the semininero		
172.	what is the female cour	nterpart of Cowper's gland	a in the male (man)	
	(a) Bartholin's gland	(b) Uterus	(c) Clitoris	(d) None of these
173.	The female rabbit is			
	(a) Spontaneous ovulat	or (b)Seasonal ovulator	(c) Natural ovulator	(d) Induced ovulator
1				

174.	. The endometrium is the lining of				
	(a) Bladder	(b) Vagina	(c) Uterus	(d) Oviduct	
175.	The process of releasin	g the ripe female gamete f	from the ovary is called		
	(a) Parturition	(b) Ovulation	(c) Fertilization	(d) Implantation	
176.	Cessation of menstrual	cycle in the human female	e is known as		
	(a) Ovulation	(b) Puberty	(c) Menopause	(d) Maturation	
177.	Proliferative age lasts u	pto how many days			
	(a) 6 th day	(b) 7 th day	(c) 14 th day	(d) 28 th day	
178.	In pre – menstrual phas	se or luteal phase, one of the	he following hormone is	increased in the blood	
	(a) Estrogen	(b) Progesterone	(c) FSH	(d) None of these	
179.	When there is no bleed	ing but high quantity of es	strogen hormone is there	, then this is known as	
	(a) Oestrous cycle	(b) Menstrual cycle	(c) Post-menstrual cycl	e (d)None of these	
180.	Release of oocytes from	n ovary of rabbit is termed	1		
	(a) Implanation	(b) Gestation	(c) Ovulation	(d) Parturition	
181.	Loss of reproductive ca	apacity in women after age	e of 45 years is		
	(a) Mensturation	(b) Ageing	(c) Menopause	(d) Menarche	
182.	Changes during menstr	rual cycle are			
	(a) Only in ovary	(b) Only in uterus	(c) Only in behaviour	(d) All of the above	
183.	Bleeding occurs in				
	(a) Oestrous cycle	(b) Oestrous and menstru	al cycle		
	(c) Menstrual cycle	(d) None of the above			
184.	The ovum in the stroma	a of ovary of a mammal is	enclosed in a perforated	l membrane called	
	(a) Germinal epitheliur	n (b)Vitelline membran	e (c)Zona pellucida	(d) Zona radiata	
185.	Oestrous cycle is sugge	estive of			
	(a) Menstruation	(b) Estrogen secretion	(c) Pregnancy	(d) Menopause	
186.	Which statement is cor	rect			
	(a) Oestrous cycle is fo	ound is found in all mamm	als		
	(b) Menstrual cycle is f	found in all mammals			
	(c) Menstrual cycle is f	found only in primates	(d) None of these		
1					

187.	Menstrual cycle is cont	trolled by			
	(a) Testosterone		(b) Testosterone and pr	rogesterone	
	(c) Estrogen		(d) Estrogen and proge	sterone	
188.	Ovulation in mammals	is triggered by a surge of			
	(a) FSH only	(b) LH only	(c) Estrogen only	(d) FSH and LH both	
189.	The blood vessels and	nerve enter the ovary thro	ugh		
	(a) Antrum	(b) Zona pellucida	(c) Hilus	(d) Graafian follicle	
190.	A female gland corresp	ponding to prostate of male	es is		
	(a) Bartholin's gland	(b) Bulbourethral gland	(c) Clitoris	(d) None of these	
191.	Hysterectomy is surgic	al removal of			
	(a) Vagina	(b) Oviduct	(c) Uterus	(d) Ovary	
192.	Abnormal condition w	hen the mammary glands	of man become female li	ike is called	
	(a) Feminization	(b) Gonochorism	(c) Gynacomastism	(d) Gynoecism	
193.	Young girls at puberty	begin to develop breasts t	his is an example of		
	(a) Metamorphosis		(b) Sexual growth		
	(c) Appearance of prim	nitive characters	(d) Artificial selection		
194.	Graafian follicles deve	lop from			
	(a) Stroma of ovaries		(b) Germinal epithelium	al epithelium of ovaries	
	(c) Both of these		(d) None of these		
195.	Menstrual cycle is cont	trolled by			
	(a) Estrogen and proge	sterone of ovary	(b) FSH and LH of pituitary		
	(c) Both (a) and (b)		(d) FSH of pituitary		
196.	Growth and maturation	n of Graafian follicle is con	ntrolled by		
	(a) FSH – LH	(b) FSH – LTH	(c) ACTH – LH	(d) GH – ADH	
197.	Ostium is the aperture	present in			
	(a) Oviduct	(b) Fallopian funnel	(c) Ovisac	(d) Cloaca	
198.	Progesterone is				
	(a) Carbohydrate	(b) Steriod	(c) Protein	(d) Sterol	

Adva	unce Level			
199.	Which one of the following phenomenon is not	common to both oestrous	and menstrual cycles	
	(a) Growth of ovarian follicles under the influen	ce of FSH and LH		
	(b) Formation of corpus luteum in the ovarian fo	llicles		
	(c) Sexual receptivity limited to a definite period	l in the cycle		
	(d) Regulation of cycles by estrogen and progste	eron		
200.	For ovulation in reflex ovulators			
	(a) Coitus is not necessary	(b) Coitus is necessary		
	(c) Plenty of food is necessary	(d) Plenty of food is no	t necessary	
201.	"Rutting season" is			
	(a) A brief period of pronounced sexual activity in males			
	(b) A brief period of pronounced sexual activity in females			
	(c) A period of rest	(d) Both (a) and (b)		
202.	The period of restoration of uterine epithelium is	s called		
	(a) Menstrual phase	(b) Proliferative phase		
	(c) Secretory or luteal phase	(d) None of these		
203.	Which one of the following exhibits menstruation	on		
	(a) Cheeta (b) Chimpanzee	(c) Civet cat	(d) None of these	
204.	The oestrous or menstrual cycle begins with a b	reaking down of the won	b wall. The ovum or egg	
	is released		1.4 1	
	(a) At the beginning of the cycle	(b) About half way thro	bugh the cycle	
	(c) About 20 days through the cycle	(d) At the end of the		
205.	The menstrual cycle in mammals accomplished	with the help of		
	(a) Progesterone and estrogen	(b) Hormones from pit	litary gland only	
	(c) Hormones from placenta only	(d) Hormones from ova	ary only	
206.	Uterine endometrium, epithelial glands and con is due to	nective tissue are broken	in menstrual phase. This	
	(a) Over secretion of FSH (b) Lack of estrogen	(c) Lack of progesteror	ne (d)Over progesterone	
207.	In female rabbit, the expanded proximal part of	the oviduct is known as		
	(a) Uterus (b) Vagina	(c) Vestibule	(d) Fimbricated funnel	
208.	If after ovulation no pregnancy results, the corpu	is luteum		
	(a) Is maintained by the presence of progesteron	e (b) Degenerates in a sh	ort time	
	(c) Becomes active and secretes lot of FSH and	LH		
	(d) Produces lot of oxytocin and relaxin			
1				

209.	9. Oral contraceptive checks				
	(a) Fertilization	(b) Implantation			
	(c) Ovulation (d) Entry of sperms into uterus				
210.	10. In female mammals Bartholin's glands open into the				
	(a) Vestibule and release	e a lubricating fluid in the	e vagina		
	(b) Uterus and release a lubricating fluid during the birth of young ones				
	(c) Urinary bladder and assist in release of urine				
	(d) Fallopian tubes and	release a secretion which	makes sperms motile		
211.	After the age of 40 th	the percentage of syndro	mes increases in the o	ffsprings of a lady. It is	
	because				
(a) Lady becomes weak (b) Oocytes grow older					
	(c) Ovaries become weak (d) Placenta becomes weak				
212.	In mammals the estroge	ens are secreted by the Gra	aafian follicle from its		
	(a) External theca	(b) Internal theca	(c) Zona Pellucida	(d) Corona radiata	
213.	Ovulation occurs				
	(a) Alternately from two ovaries (b) Simultaneously from both the ovaries				
	(c) From one ovary alon	ne throughout the life	(d) According to the se	ason from two ovaries	
214.	Human uterus is				
	(a) Paired with well sep	parated oviducts			
	(b) Single large chambe	er with posterior part of ov	viduct fused to it anterio	rly	
	(c) Paired with partially	fused oviducts			
	(d) A single large cham	ber with completely fused	loviducts		
215.	In ladies, the oviducts a is called	are cutted or removed sur	gically to avoid the cha	nces of fertilization. This	
	(a) Vasectomy		(b) Ovariodectomy		
	(c) Sterilizaion		(d) Tubectomy (Salpin	gectomy)	
216.	The phase of menstrual	cycle in humans that last	for 7–8 days is		
	(a) Follicular phase	(b) Ovulatory phase	(c) Luteal phase	(d) Menstruation	
217.	Secretion of progestero	ne by corpus luteum is ini	tiated by		
	(a) LH	(b) MSH	(c) Testosterone	(d) Thyroxine	

218. In human female which of the following is incorrect (a) Menstrual cycle takes 28 days (b)Menopause occur at 45-55 years (c) The ovulated egg released during pregnancy die (d)Menstruation takes 4 days **219.** If both ovaries are removed from a rat, then which hormone is decreased in blood (c) Prolactin (a) Oxytocin (b) Estrogen (d) Gonadotrophic **220.** Which type of hormone controls the menstrual cycle in human being (c) Progesterone (a) LH (b) FSH (d) FSH, LH, Estrogen **221.** Fimbriated funnel is (a) Proximal part of oviduct (b)Uterus part (c) Urinary bladder part (d)Ureter part 222. The rupture of the graafian follicle and the release of ovum occurs under the influence of (d) GH (a) LH (b) FSH (c) MSH **223.** Prepuberal period refers to a stage of (a) Growth enlargement of organ systems and maturation of reproductive mechanisms (b) Initiation of gonads (c) Initiation of organs (d) Maturation of gonads alone 224. Ripe ova are shed by ovaries into (a) Oviducal funnel (b) Coelom (c) Oviduct (d) Collecting tubules of kidney 225. Bartholin's glands are situated (a) On either side of vas deferens in humans (b) On the sides of the head of frog (c) At the reduced tail end of birds (d) On either side of vagina in humans **226.** Onset of menstruation is due to (a) Fall in level of progesterone (b) Increase in level of progesterone (c) Increase in level of FSH (d) None of these **227.** Both corpus luteum and macula lutea are (a) Found in human ovaries (b) A source of hormones (c) Characterized by a yellow colour (d) Contributory in maintaining pregnancy **228.** Ovulation does not occur during pregnancy in the human female because (a) The follicles are not influenced by the level of progesterone in the blood (b) The corpus luteum and later the placenta produce large amounts of progesterone (c) The corpus luteum generates as luteinising hormone is no longer produced (d) The embryo produces hormones which retard the production of maternal follicle stimulating hormones

229.	•. Which one of the following is least present in the endometrium during the proliferative phase of the menstrual cycle				
	(a) Cork screw – shaped	d uterine glands	(b) Ciliated cells		
	(c) Mitosis of stomal ce	ells	(d) Straight arteries		
230.	Cervix lies between		-		
	(a) Oviduct and uterus	(b) Uterus and vagina	(c) Vagina and clitoris	(d) Clitoris and labia	
231.	Vaginal orifice, urethra	l orifice and clitoris are pr	rotected by		
	(a) Labia majora	(b) Labia minora	(c) Vulva	(d) Anus	
232.	Vulva is enclosed by				
	(a) Vaginal orifice		(b) Clitoris		
	(c) Labia majora		(d) Labia majora and m	inora both	
233.	Vestibular glands secre	te			
	(a) Hormones	(b) Enzymes	(c) Mucus	(d) Digestive juice	
234.	234. Follicular atresia is				
	(a) Degeneration of zygote				
	(b) Degeneration of enlarge follicles before puberty				
	(c) Degeneration of em	bryo	(d) Formation of corpos	s luteum	
235.	Transformation of a you	ung follicle into graafian f	follicle is controlled by		
	(a) Progesterone		(b) Lactogenic hormone	e	
	(c) Follicular stimulatin	ig hormone	(d) Luteininsing hormo	ne	
236.	Note the relationship be Mesovarium : Ovary ::	etween the first two words Mesometrium	s and suggest a suitable	word for the fourth place	
	(a) Clitoris	(b) Uterus	(c) Testis	(d) Penis	
237.	If ovaries of a pregnant	mammal are removed			
	(a) The embryonic deve	elopment will stop	(b) Embryo will regene	rate	
	(c) Development remain	ns unaffected	(d) Ovaries will regener	rate	
238.	When a mature egg leav	ves the ovary, it enters			
	(a) Follicle	(b) Endometrium	(c) Interstitial cells	(d) Fallopian tubes	
239.	The period that makes child bearing period is a	physiological cessation reffered as	of menstrual flow and	consequently the end of	
	(a) Amenorrhoea	(b) Female sterlity	(c) Female climacteric	(d) Menstrual cycle	

	240.	b. Ovulation can be detected by				
		(a) Rise in basal body t	emperature	(b) Fern pattern of the o	cervical mucosa	
		(c) Urinary estradiol ex	cretion	(d) Plasma cholestrol e	stimation	
	241.	The cavity present in th	e graafian follicle is			
		(a) Amniotic cavity	(b) Archenteron	(c) Antrum	(d) Ostium	
	242.	Ostium is provided with	h a number of finger like J	processes fimbriae		
		(a) For receiving ovum	(b) To increase the catch	ing area		
		(c) both (a) and (b)	(d) To secrete hormones			
	243 .	Immediately after ovula	ation, the mammalian egg	is covered by a membra	ne known as	
		(a) Chorion	(b) Zona pellucida	(c) Corona radiata	(d) Vitelline membrane	
	244.	The immediate cause of	f induction of ovulation in	human female is the lar	ge plasma stage of	
		(a) Progesterone	(b) Estrodiol	(c) LH	(d) FSH	
	245.	In which phase of mens	strual cycle the progestero	ne is absent and estrogen	n level is high in blood	
		(a) Menstrual phase	(b) Post menstrual phase	(c) Proliferative phase	(d) Ovulation	
	246.	46. Ovulation in the case of rabbit is different from man as it occurs				
		(a) Inspring season (b) Under nervous stimuli				
		(c) After copulation	(d) Under hormone stimu	ıli		
	247.	Menopause is the stage	in females when			
		(a) Menstruation cycle	starts	(b) Puberty is delayed		
		(c) Reproductive capac	ity is arrested	(d) Ovaries enlarge		
	248.	Decrease in the level of	f progesterone and estroge	n causes		
		(a) Growth and dialatio	on of myometrium			
		(b) Loss of endometrium	m			
		(c) Release of an ovum	from ovaries			
		(d) Constriction of uter	ine blood vessels leading	to sloughing of uterine e	pithelium	
	249.	Monoestrous animals a	re those which have			
		(a) One menses each m	onth	(b) One ovulation each	month	
		(c) One egg		(d) One breeding seaso	n in the year	
	250.	Human ovary is connec	cted to the uterus by the			
		(a) Rounded ligament	(b) Proper ligament	(c) Infundibulum	(d) Isthmus	
	251.	The phase of menstrual	cycle when fertilization i	s possible		
		(a) Follicular	(b) Leuteal	(c) Bleeding phase	(d) Any of these	
	252.	Probable fertility period	d of menstrual cycle is fro	m to day		
		(a) 5 – 8	(b) 9 – 12	(c) 13 – 16	(d) 17 – 20	
- 1						

GAMETOGENESIS

Basi	ic Level			
253.	Germ cells in mammali	ian gonads are produced b	у	
	(a) Only mitosis		(b) Only meiosis	
	(c) Mitosis and meiosis	both	(d) Without cell divisio	n
254.	Cumulus covers			
	(a) Ovary	(b) Ovum	(c) Embryo	(d) All of these
255.	The eggs of insects are			
	(a) Mesolecithal and ce	entrolecithal	(b) Macrolecithal and c	centrolecithal
	(c) Mesolecithal and te	lolecithal	(d) Macrolecithal and t	elolecithal
256.	The minute cells which	separate from the develop	ping ova during their ma	turation are called
	(a) Polar bodies	(b) Primary spermatocyte	es (c)Primary oogonia	(d) Secondary oocytes
257.	A freshly unfertilized e	gg of hen contains		
	(a) One cell	(b) 100 cells	(c) 1,000 cells	(d) 10,000 cells
258.	The acrosome of the sp	erm contains		
	(a) Sugar	(b) Enzymes	(c) Cytoplasm	(d) Nucleus
259.	Between the spermatog	gonia are the		
	(a) Epithelial cells	(b) Cells of Sertoli	(c) Lymph spaces	(d) Capillaries
260.	The middle piece of spe	ermatoaoan contains		
	(a) Nucleus only		(b) Centriole only	
	(c) Nucleus and mitoch	nondria	(d) Mitochondria and c	entriole
261.	Among vertebrates whi	ich has the smallest size of	f ova	
	(a) Birds	(b) Mammals	(c) Reptiles	(d) Amphibians
262.	The size of human egg	is		
	(a) 1.5 <i>mm</i>	(b) 0 . 15 <i>mm</i>	(c) 0.05 <i>mm</i>	(d) 0.3 <i>mm</i>
263.	The size of the egg chie	efly depends upon the		
	(a) Size of the animal		(b) Amount of yolk res	erves in it
	(c) Amount of food tak	en by the mother	(d) All the above	
264.	The germ cells are deri	ved from		
	(a) Endoderm	(b) Ectoderm		
	(c) Mesoderm	(d) Ectodrm and mesoder	rm	
265.	Nucleus in a sperm is s	(b) Middle and a	(a) T a : 1	
	(a) Head	(b) Milddle piece	(c) 1 an	(u) Acrosome

266.	Process of synthesis of	yolk is known as		
	(a) Vitellogenesis	(b) Oogenesis	(c) Histogenesis	(d) Glycogenesis
267.	Head of a mature spern	n is composed of		
	(a) Elongated nucleus c	covered by acrosomal mate	erial (b)Two centrioles	and axial filament
	(c) Acrosome without r	nucleus	(d)Mitochondrial	sheath and cytoplasm
268.	Egg of rabbit and man	are		
	(a) Microlecithal	(b) Megalecithal	(c) Telolecithal	(d) Isolecithal
269.	How many spermatozo	a are produced by a secon	dary spermatocyte	
	(a) 4	(b) 8	(c) 1	(d) 2
270.	The immatured stage eg	ggs are called as		
271.	Massive amount of yol	k present in the vegetal reg	gion of the egg, makes a	n egg
	(a) Oligolecithal	(b) Mesolecithal	(c) Telolecithal	(d) Centrolecithal
272.	Cleidoic eggs are found	l in		
	(a) Birds	(b) Mammals	(c) Annelids	(d) Molluscs
273.	Sperms and ova arise fr	om		
	(a) Collencytes	(b) Spongioblasts	(c) Archeocytes	(d) Scleroblasts
274.	Number of spermat	ozoons, a single prin	mary spermatocyte u	ltimately produces in
	spermatogenesis, is			
	(a) One	(b) I wo	(c) Four	(d) Eight
275.	At the end of first melo	tic division, the male gern	(b) Drimory spormatos	uto
	(a) Spermatogomum	ocyte	(d) Spermatid	yte
276	If the growth of sperma	ntid is normal and all cells	survive then the numb	er of sperms formed from
2/0.	50 primary spermatocy	tes will be	survive, then the numb	er of sperms formed from
	(a) 50	(b) 100	(c) 200	(d) 25
277.	Somatic chromosome seminiferous tubule	number is 40. What s	hall be chromosome	number in the cells of
	(a) 40	(b) 20	(c) 10	(d) 40 and 20
278.	The human sperm was	first seen and discovered l	ру	
	(a) Hamm and Leeuwer	nhoek	(b) Haeckel	
	(c) Spallanzani		(d) Von Baer	
1				

279.	b. How many sperms and ova will be produced from 25 primary spermatocytes and 25 primary occytes respectively			
	(a) 100 sperm sand 25 (ova	(b)100 sperms and 50	OVA
	(c) 50 sperms and 25 or	va	(d) 100 sperms and 10	0.0 va
280.	50 secondary oocytes i	n female and 50 secondary	spermatocytes in male	e give rise to
_00.	(a) 100 ova and sperms		(b) 200 ova and 50 spe	erms
(a) 100 ova and 200 sperms (d) 50 ova and (c)			(d) 50 ova and 100 spe	erms
281.	The function of egg cel	1 is / are		
(a) It supplies a haploid set of chromosomes to the future embryo				
(b) It provides most of the cytoplasm to the embryo				
	(c) It supplies food rese	erves to the embryo	(d) All the above	
282.	Leathery eggs are found	d in		
	(a) Amphibians	(b) Reptiles		
	(c) Birds	(d) Prototherian mammal	ls	
283.	A sperm without across	ome, cannot		
	(a) Get food supply		(b) Move	
(c) Penetrate into the seminal vesicle (d) Penetrate into		(d) Penetrate into the o	ovum	
284.	The middle piece of spe	e piece of sperm provides		
	(a) Chromosomes	(b) Energy	(c) Food	(d) Genes
285.	Vitelline glands produc	e		
	(a) Ova	(b) Yolk cells	(c) Shell	(d) Mucus cells
286.	Human eggs are			
	(a) Microlecithal	(b) Alecithal	(c) Macrolecithal	(d) Mesolecithal
28 7.	Eggs of reptiles and bir	ds are		
	(a) Alecithal	(b) Isolecithal	(c) Telolecithal	(d) Homolecithal
288.	Oogenesis is the proces	ss for the formation of		
	(a) Red blood cells	(b) Sperms	(c) Ova	(d) Sperms and ova
289.	First meiotic division d	uring oogenesis occurs in		
	(a) First polar body	(b) Second polar body	(c) Primary oocyte	(d) Secondary oocyte
290.	Each primary spermato	cyte gives rise to		
	(a) Four diploid sperma	atids	(b)Eight diploid spern	natids
	(c) Four haploid sperma	atids	(d) Eight haploid sper	matids
291.	The diploid stages in ga	ametogenesis are		
	(a) Primary spermatocy	te and spermatogonium	(b) Spermatogonium a	and spermatid
	(c) Secondary spermato	ocyte and spermatid	(d) Primary spermator	cyte and spermatocyte

292.	The first step in reproduction at the cellular level is				
	(a) Formation of specia	ll sex cells	(b)Cell division		
	(c) Rapid increase in ce	ell volume	(d)Constriction of cyto	plasm	
293.	• Of the following animals which produces the smallest egg				
	(a) Humming bird	(b) Salmon	(c) Blue whale	(d) American toad	
294.	The diameter of mammalian ovum is				
	(a) 50 microns	(b) 100 microns	(c) 2000 microns	(d) 40,000 microns	
295.	During pre-vitellogenes	sis period of growth			
	(a) Nucleus of the prim	ary oocyte increases trem	endously in volume		
	(b) Cytoplasm of the pr	rimary oocyte increases in	volume		
	(c) Both nucleus and cy	ytoplasm of the primary of	ocyte increases tremendo	ously in volume	
	(d) Formation of yolk ta	akes place			
296.	Tertiary egg membrane	es are lacking in mammals	with the exception of th	e	
	(a) Euetherians	(b) Metatherians	(c) Prototherians	(d) None of the above	
297.	The eggs in which fate	of every part of the egg be	ecomes fixed are called		
	(a) Cleidoic eggs	(b) Non-cleidoic eggs	(c) Mosaic eggs	(d) Regulative eggs	
298.	Jelly layer of frog is				
	(a) Primary membrane (b) Secondary membrane (c) Secreated by the egg(d) Tertiary membrane				
299.	Vegetal hemisphere of	egg consists of			
	(a) Yolk	(b) Pigment	(c) Grey crescent	(d) Germinal vesicle	
300.	Ova in mammals were	first identified by			
	(a) Malpighi	(b) Wolff	(c) Von Baer	(d) Aristotle	
301.	Which of the following	g parts of the spermatozoar	n arises from centriole		
	(a) Apical cap	(b) Head	(c) Middle piece	(d) Tail	
302.	Immediately after ovula	ation the mammalian egg	is covered by a membrai	ne known as	
	(a) Vitelline membrane	e (b) Chorion	(c) Zona pellucida	(d) Corona radiata	
303.	The number of polar bo	odies produced at the end	of second meiotic division	on in female reproductive	
	cells 1s	(h) 2	(a) 1	0 (1)	
	(a) 5 Cookroach agg is called	(D) 2	(c) 1	(a) 0	
304.	(a) Microlecithal	(b) Macrolecithal	(c) Isolecithal	(d) Centrolecithal	
205	The process by which a	(b) Macrorectular	s	(u) centroiceithai	
303.	(a) Oogenesis	(b) Ovulation	(c) Oviposition	(d) Oviparity	
306.	How many eggs will be	e formed form 100 primar	v oocvtes	(d) o upanty	
	(a) 300	(b) 400	(c) 200	(d) 100	
307.	In which part of the spe	ermatozoa mitochondria a	re present		
	(a) Head	(b) Neck	(c) Middle piece	(d) Tail	

308.	. Clupein protein occurs	in		
	(a) Human sperms	(b) Avian sperms	(c) Human ova	(d) Avian ova
309.	Oogenesis comprises			
	(a) Multiplication phase	e(b) Growth phase	(c) Maturation phase	(d) All the above
310.	Telolecithal eggs have			
	(a) Equal distribution o	f yolk	(b) Average amount of	yolk
	(c) Yolk present at a dis	stance from nucleus	(d) All the above	
311.	Egg which contains ver	y little amount of yolk are	e called as	
	(a) Alecithal	(b) Microlecithal	(c) Mesolecithal	(d) Polylecithal
312.	The tail of the spermate	ozoan is subdivided into		
	(a) Two regions	(b) Three regions	(c) Four regions	(d) Single piece
313.	The actual genetic part	of sperm is		
	(a) Tail	(b) Middle piece	(c) Head	(d) Whole of it
314.	The sperm head in man	is		
	(a) Rod – shaped	(b) Spoon – shaped	(c) Cork screw – shape	d (d)Spheroidal
315.	Tertiary egg membrane	is		
	(a) Vitelline membrane	(b) Zona radiata	(c) Albumen	(d) Corona radiata
316.	The process of maturat	ion of reproductive cells of	of testes in male so as to	form the male gamete or
	sperm is known as			
	(a) Spermatogenesis	(b) Gametogenesis	(c) Oogenesis	(d) None of these
317.	The acrosome of sperm	is formed by		
	(a) Lysosome	(b) RER	(c) Golgi body	(d) Mitochondria
318.	Acrosome is found in the	he sperm at		
	(a) Top part	(b) Middle piece	(c) Behind the nucleus	(d) Tail pat
319.	Microlecithal eggs are	found in		
	(a) Reptilia + Aves		(b) Amphibia + Aves +	Reptilia
	(c) Reptilia + Aves + C	hiroptera	(d) Eutheria	
320.	How many chromosom	es are there in spermatids	of man	
	(a) 23	(b) 46	(c) 48	(d) 24
321.	Eggs having yolk in the	err centre of cytoplasm in j	peripheral layer are calle	d
	(a) Isolecithal	(b) Microlecithal	(c) Centrolecithal	(d) Telolecithal
322.	The middle piece of the	e sperm contains		
a -	(a) Centriole	(D) INUCIEUS	(c) Proteins	(a) Mitochondria
323.	I ne egg of frog 1s	(b) Magalasithal	(a) Talalasithal	(d) Contrologithal
	(a) isolectinal	(b) Mesolecitnal	(c) reiolecitnal	(a) Centrolecitnal

324.	. How many secondary spermatocytes will form 400 spermatozoa				
	(a) 100	(b) 400	(c) 40	(d) 200	
325.	Sperm head mainly contains the				
	(a) Nucleus	(b) Golgi body	(c) Centrosome	(d) Mitochondria	
326.	Eggs of placental mam	mals are			
	(a) Homolecithal	(b) Alecithal	(c) Microlecithal	(d) Mesolecithal	
327.	Mammalian eggs have				
	(a) No yolk at all	(b)Small amount of y	volk		
	(c) Large amount of yo	lk (d)Large amount of y	olk concentrated at one	pole	
328.	Mammalian ovum is su	rrounded by			
	(a) Zona reticulata	(b) Zona pellucida	(c) Zona fasciculata	(d) None of these	
329.	Process of spermatogen	esis is under the regulator	ry influence of		
	(a) Oxytocin		(b) Vassopressin		
	(c) Follicle stimulating	hormone	(d) Luteotrophic hormo	one	
330.	The first step in the sex	ual reproduction of anima	lls is		
	(a) Spermatogenesis	(b) Spermateleosis	(c) Oogenesis	(d) Gametogenesis	
331.	Polar bodies are formed	l during			
	(a) Oviposition	(b) Oogenesis	(c) Fertilization	(d) Spermatogenesis	
332.	. Spermeiogenesis is the process in which				
	(a) Spermatids change into spermatozoa (b) Spermatogonia produce spermatids				
	(c) Spermatocytes give rise to spermatozoa				
	(d) Dormant spermatoz	oa become active just befo	ore ejaculation		
333.	One of the minute cell	which separates from the a	animal egg during matur	ation is known as	
	(a) Primary spermatogo	onia (b)Secondary oogonia	a(c) Primary oogonia	(d) Polar bodies	
334.	Unfertilized egg of hun	nan contains or When rele	ased from ovary, human	egg contains	
	(a) One <i>Y</i> chromosome	(b) X and Y chromosome	e (c)XX chromosome	e (d) One X chromosome	
335.	The layer of cells imme	ediately surrounding the or	vum but outside the zona	a pellucida is called	
	(a) Corona radiata	(b) Membrana granulosa	(c) Theca interna	(d) Cerminal epithelium	
336.	The membrane investin	g the ovum just outside th	ne membrana granulosa i	S	
	(a) Zona pellucida	(b) Theca interna	(c) Vitelline membrane	e (d) Discus Proligerous	
337.	Spermatozoan term was	s coined by			
	(a) Von Baer	(b) Leeuwenhoek	(c) Spemann	(d) Swammerdam	
338.	Spermioteleosis is anot	her name of			
	(a) Maturation of ovum	(b) Spermiogenesis			
	(c) Spermatogenesis	(d) Degeneration of speri	ms		

339.	. Correct sequence of cell stages in spermatogenesis is				
	(a) Spermatocytes, spermatids, spermatogonia spermatozoa				
	(b) Spermatogonia, sper	matocytes, spermatids sper	matozoa		
	(c) Spermatocytes, sper	rmatogonia, spermatids sp	permatozoa		
	(d) Spermatogonia, spe	ermatids, spermatocytes sp	permatozoa		
340.	. The products of the first	st maturation division of g	germ cell in testis are kno	own as	
	(a) Spermatids		(b) Oocytes		
	(c) Secondary spermato	cytes	(d) Sperms		
341.	Number of chromosom	es in primary spermatocy	te of frog is		
	(a) Same as in seconda	ry spermatocyte	(b) Same as in spermat	id	
	(c) Half of that in sperr	natogonium	(d) Same as in spermat	ogonium	
342.	Which one of the follow	wing is haploid			
	(a) Oogonia	(b) Primary spermatocyt	te (c) Primary oocyte	(d) Secondary oocyte	
343.	Primary sex cells conta	in			
	(a) As many chromoso	me as the sperm	(b) Haploid set of chro	mosomes	
	(c) As many chromoso	mes as the ovum	(d) Diploid set of chron	mosomes	
344.	Haploid number of chro	omosomes is found in			
	(a) Amoeba	(b) Bacteria	(c) Ovum	(d) Zygote	
345.	Acrosome aids the spen	rm to			
	(a) Penetrate vitelline r	nembrane of ovum	(b) Find ovum		
	(c) Swim		(d) Higher activity		
346.	Spermatogenesis and sp	perm differentiation are u	nder the control of		
	(a) FSH	(b) LH	(c) Testosterone	(d) Parathyroid	
	hormone				
347.	Enzyme hyaluronidase	is synthesised in			
	(a) Head of sperm		(b) Golgi bodies of acrosome		
	(c) Lysosome of acroso	ome	(d) Tail of sperm		
Adv	ance Level				
348.	At which stage of speri	matogenesis sperm acqui	re their whole structural	maturity and they contain	
	(a) Spormio genesis	(h) Crowyth phase	(a) Multiplication phase	a(d) Maturation phase	
	(a) Spermiogenesis	(b) Growin phase	(c) Multiplication phas	se(d) Maturation phase	
349.	Lampbrush chromoson	nes are found inside		11 /1	
	(a) Oocytes of frog	1 '1	(b) Salivary gland of si	llk moth	
	(c) Salivary gland of di	rosopnila	(a) Inucleus of man	C.1 11 1	
350.	•. The cytoplasm surrounding the mitochondria found in the middle piece of the sperm is called				
	(a) Acrosome	(b) Centrosome	(c) Microsome	(d) Manchette	

	01 1	, , . ,				
351.	Cledoic egg is an adap	tation to				
	(a) Aquatic life	(b) Marine life	(c) Terrestrial life	(d) Aerial life		
352.	In mammals egg are m	icrolecithal and isolecithal	because these are			
	(a) Oviparous	(b) Viviparous	(c) Ovoviviparous	(d) None of these		
353.	. How many ova and sperms would be produced from 100 secondary oocytes and 100 secondary					
	spermatocytes during g	gametogenesis in human				
	(a) 100 ova, 100 sperm	IS	(b) 100 ova, 200 sperm	18		
	(c) 50 ova, 100 sperms		(d) 200 ova, 200 sperm	18		
354.	The acrosome plays in	portant role in				
	(a) Motility of sperm		(b) Penetrations of ovu	im by sperm		
	(c) Providing energy to	o sperm	(d) None of these			
355.	Which of the following	g statement is wrong as reg	gards to man			
	(a) All eggs are alike	(b) Eggs are of two types	s (c) Sperms are of two	types(d)None of these		
356.	During their differentia	ation the spermatids are as	sociated with			
	(a) Leydig cell		(b) Sertoli cells			
	(c) Kupffer cells		(d) Primary spermatogonial cells			
357.	7. Factors which determine polarity of eggs are					
	(a) Direct electric curre	ent	(b) Presence of neighb	ouring eggs		
	(c) Position of sperm entry (d) Unequal distribution of substances in egg					
358.	358. In frog chromosome no. is reduced to half					
	(a) When 2 nd polar body is separated (b) When 2 nd polar body is divided					
	(c) When 3 rd polar body is separated (d) When 1 st polar body is separated					
359.	359. Which mammals have more yolk than cytoplasm in their eggs					
	(a) Placental mammals (b) Aquatic mammals					
	(c) Marsupials	(d) Egg laying mammals				
360.	Vitellogenesis is the pr	rocess of				
	(a) Formation of vitelli	ne membrane around the d	developing egg cells			
	(b) Formation of yolk	sac membrane around the	yolk mass during the de	evelopment of reptiles and		
	$\begin{array}{c} \text{Dirds} \\ \text{(a) } \text{Security a size of secult} \end{array}$		· · · · · · · · · · · · · · · · · · ·			
	(c) Synthesis of york at	nd its deposition within the	e growing oocyte of am	phibians		
	(d) Both (a) and (c)	wing statement is some st				
361.	(a) Albuman acuaring	ages of frog swalls and f	arma protoctivo iolly of	or coming in contact with		
	(a) Albumen covering	eggs of flog swells and fo	onis protective jeny an	er conning in contact with		
	(b) Fertilization in rab	nit is helped by hyaluronid	ase which is present in a	2006		
	(c) During fertilization	in rabbit the entire sperm	including tail enters ego	~55° 0		
	(c) During fertilization in rabbit the entire sperm including tail enters egg (d) In case of tood, fortilization takes place in moist soil					
	(u) in case of toau, retuinzation takes place in moist som					

362.	Blastodisc or germinal disc refers to the protoplasm of egg, this is restricted to small area in				
	(a) Amphibian egg	(b) Avian egg	(c) Ascidian egg	(d) Mammalian egg	
363.	The significance of the	unequal cytokinesis dur	ing oogenesis is		
	(a) One cell out of the 4	4 daughter cells inherit r	nost of the cytoplasm and	d reserve food material for	
	developing embryo				
	(b) To reduce the numb	er of ova produced			
	(c) To form polar bodie	S			
	(d) None of the above				
364.	Egg in surrounded by a	protective egg – case ca	alled the mermaid's purse	is found in	
	(a) Mammals		(b) Reptiles		
	(c) Oviparous sharks an	nd rays	(d) None of the above		
365.	The undifferentiated pr	imordial germ cells are	e larger in size and their	chromatin rich nuclei are	
	distinct in				
	(a) Multiplication phase	e(b) Growth phase	(c) Maturation phase	(d) All the above	
366.	Motility of mammalian	sperm is dependent on i	its		
	(a) Tail only		(b) Middle piece only		
	(c) Head only		(d) Tail and middle piece both		
367.	A hatching egg of chick	is covered by plaster of	f paris. It is harmful for		
	(a) Mother	(b) Respiration	(c) Excretion	(d) None of these	
368.	In mammals growing of	ocytes are surrounding b	by special nutritive cells of	called	
	(a) Follicle cells	(b) Nurse cells	(c) Both (a) and (b)	(d) None of the above	
369.	. The plasma membrane of oocyte and that of follicle cells show close connections at some points				
	in the form of				
	(a) Microvilli		(b) Desmosomes		
	(c) Cytoplasmic process	ses	(d) None of the above		
370.	(a) They are yorry small	in size (b)They	have very little extenleer	n with no food reconvec	
	(a) They are non func	tional (d) All th	e above	II with no root reserves	
971	Movement of sperm is a	done by			
3/1.	(a) Tail	(b) Head	(c) Acrosome	(d) Middle niece	
372.	Life span of human spe	rm is	(c) refosome	(u) Mildale piece	
J/=•	(a) 1 hour	(b) 10 hours	(c) 24 hours	(d) 24 days	
373.	The oocvte collects the	volk and other nutrients	from the follicle cells by	the process of	
U/U	(a) Osmosis	(b) Diffusion	(c) Pinocytosis	(d) All the above	
374.	After oogenesis how ma	any polar bodies and over	a are formed		
<u> </u>	(a) 1 matured ovum $+ 3$	polar bodies	(b) 2 matured ova $+ 2$	polar bodies	
	(c) 3 matured ova $+$ 3 p	olar bodies	(d) None of these	•	
	Ĩ				

375.	Function of the ring ce	ntriole is		
	(a) To form a spindle s	ystem	(b) To form the axial fi	lament of the flagellum
	(c) To form the manchette		(d)Not known	
376.	Yolk of egg in the verte	ebrates is formed in		
	(a) Ovum	(b) Lungs	(c) Liver	(d) Kidney
377.	After 2^{nd} maturation division, which is meiotic 2^{nd} phase the result is			
	(a) Formation of matured ovum		(b) Formation of ovum	
	(c) Formation of embryo (d) Formation of sperm			1
378.	. The first meiotic division in the oogonium is completed when the egg is within the			
	(a) Uterus		(b) Follicle	
	(c) Fallopian tube		(d) Ovary, before it is s	surrounded by follicles
<u>ANSWER</u>

REPRODUCTIVE SYSTEM

ASSIGNMENT (BASIC & ADVANCE LEVEL)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
a	с	b	b	с	b	a	b	с	b	a	a	d	a	a	d	a	a	b	b
21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
b	b	d	b	d	d	d	d	b	b	b	d	a	a	a	a	a	с	a	a
41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
d	С	с	с	a	b	с	b	b	a	a	d	a	c	c	b	d	d	b	b
61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
с	С	d	с	b	c	d	с	d	a	b	с	a	b	a	a	b	с	a	d
81	82	83	84	85	86	8 7	88	89	90	91	92	93	94	95	96	97	98	99	100
с	b	b	c	с	c	a	b	b	c	b	d	a	d	b	d	d	b	b	c
101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120
a	С	b	d	b	d	d	b	d	d	b	b	d	b	b	С	d	a	b	а
121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140
a	С	с	c	c	a	d	b	b	с	b	a	b	b	b	С	d	a	d	с
141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160
с	С	a	c	b	a	d	с	d	a	b	b	d	b	b	a	d	b	d	а
161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180
a	С	a	d	a	d	с	b	d	b	с	a	d	c	b	с	с	b	a	с
181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200
с	d	с	с	b	с	d	d	с	d	с	с	b	b	с	a	b	b	с	b
201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220
a	b	b	b	a	c	d	b	b,c	a	b	b	a	b	d	b	a	с	b	d
221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	23 7	238	239	240
a	а	a	a	d	a	с	b	a	b	с	d	c	b	c	b	a	d	с	a
241	242	243	244	245	246	24 7	248	249	250	251	252	253	254	255	256	25 7	258	259	260
с	с	b	с	с	c	с	d	d	b	b	с	с	b	a	a	a	b	b	d
261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280
b	b	b	a	a	a	a	a	d	с	с	a	c	с	c	с	d	a	a	d
281	282	283	284	285	286	28 7	288	289	290	291	292	293	294	295	296	29 7	298	299	300
d	d	d	b	b	b	c	c	c	c	a	b	c	b	c	с	c	d	a	с
301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320
d	С	a	d	a	d	с	a	d	с	b	a	c	b	c	a	с	a	d	a

321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340
с	d	b,c	d	a	b	a	b	с	d	b	a	d	d	a	b	a	b	b	с
341	342	343	344	345	346	34 7	348	349	350	351	352	353	354	355	356	357	358	359	360
d	d	d	c	a	a	b	a	a	d	c	b	b	b	b	b	d	d	d	с
361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	378		
a	b	a	c	a	d	b	a	b	b	a	c	c	a	d	a	a	b		
